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Memoirs of the Department of Agriculture in India

THE FOOD OF BIRDS IN INDIA

BY

C. W. MASON, M.S.E.A.C

Lately Supernumerary Entomologist, Imperial Department of Agriculture for India

EDITED BY

H. MAXWELL-LEFROY, M.A., F.E.S., F.Z.S

Imperial Entomologist

AGRICULTURAL RESEARCH INSTITUTE, PUSA

PUBLISHED FOR

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PREFACE.

The following pages contain a summary of the recorded facts of the Food of Birds in India, and a statement of the food of the individual birds shot or observed by Mr. Mason at Pusa in 1907, 1908, 1909. It has been necessary to edit the original manuscript and I have added a short section (IV) in which I have tried to sum up the practical results and to make the question clearer to the reader who is not an Entomologist. My responsibility ends there, and the student of birds will find Mr. Mason's observations in the body of the work. The identification of the insects in the stomachs was partly done by the staff in charge of the collections here and Mr. C. H. Tipper kindly identified the Molluscs in the Indian Museum. I have revised the nomenclature of the insects throughout and believe it to be correct; the author is responsible for the identification of the birds.

The identification of material in the stomachs is not easy and has not been possible in the case of the seeds; we will gladly do what we can to assist other observers in this respect with insects if they will send preserved stomachs, but we can only do so, as a rule, in the case of birds shot in the plains.

H. M. L.

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INTRODUCTION.

This paper is largely a compilation from various sources of what little is known of the food of Indian birds at the present time. It contains also numerous field notes on the food of the common species of the plains together with the records of 1,325 stomachs which have been examined in the laboratory. Many of the quotations are practically reduplications of each other, and they have been quoted in order to have all references from the works of various authors in one paper, and therefore in the form which anyone interested in economic ornithology may find most useful. In most cases, especially with the game birds and ducks, I have quoted in full, paraphrasing only where a full quotation was unnecessary. In the case of the birds I have myself been able to examine, the references have frequently been compounded with my own field notes, the reference being acknowledged. The literature at my disposal has been somewhat limited and there may be records in papers and works already existing which I have been unable to consult. I have quoted from Evans (Cambridge Natural History, Birds), as this work, though necessarily not containing much more

than a wide generalization of the food of birds, and much of which does not apply directly to India, gives a very good idea of what the food of various orders of birds consists.

There is a great deal of literature from other countries on the food of many of our Indian birds, and in all probability foods of widely distributed species differ but little in different localities. We cannot, however, assume that this is so, nor even that because a bird is beneficial or injurious in one country it is equally so in another, where climatic conditions and food-supply are different. We must know the food of Indian birds in India.

The following works have been consulted, and the abbreviation used in the text are here given :—

"Birds of India." Jerdon	Jerd. B. I.
"Game Birds of India, Burma and Ceylon." Hume and Marshall ...	H. M. G. B.
Indian Museum Notes	I. M. N.
Journal of the Bombay Natural History Society	B. N. H. S. J.
Journal of the Asiatic Society of Bengal	A. S. B.
"Fauna of British India." Birds. Oates and Blandford	F. I.
"Indian Ducks and their Allies." Stuart-Baker	S. B. I. D. A.
"Birds." Evans. Cambridge Natural History	E. C. N. H. B.
"Game, Shore and Water Birds." A. le Messurier	A. le M.
"Birds of the Plains." Dewar	Dewar. B. P.
"The Indian Crow." Dewar	Dewar. I. C.
Manual of Forest Zoology. Stebbing	S. M. F. Z.
Dictionary of Economic Products of India. Watt	Watt.

District Gazetteers for Assam, Baluchistan, Bombay, Central Provinces, Madras, North-West Frontier Province, North-West Provinces, Province of Oudh, Punjab and of the Sirmur State. The general account of birds in the Imperial Gazetteer has also been consulted; this latter account gives an excellent description of the general distribution of birds throughout India.

It will be noticed that some well-known papers such as "Stray Feathers" are not included in these works consulted as they were not available.

PART I.

Economic Entomology is a subject that has only recently been dealt with in India and that inadequately. In England even, it is not so advanced as one would expect, due to the fact that there is no definite organisation for the study of the subject. Many countries, notably the United States of America, Germany, France, Austria, have accumulated a large amount of information on this subject.

In India we have had and still have many first class observers of Birds. Ornithology is a subject which naturally appeals to most men whose work or leisure takes them into various districts and especially the wilder and little known ones. The observations of these men have naturally tended in a few directions, namely, a definite knowledge of what species of birds occur within Indian limits, a knowledge which is all-important from an economic side of the question, definite localities in which the various species occur, their life-history and general habits. Very little is on record with regard to the actual food of birds, and no definite work has been done in this direction. It is now a generally recognised fact that birds play a very important part in checking ravages of insects on the farm and elsewhere. But owing to ignorance, lack of observation and often to faulty observation, a very small percentage of the good done by birds in checking undue proportion of insect life is attributed to them, and for similar reasons some birds at present considered beneficial are injurious and *vice versâ*, or else fall under a neutral heading, whilst others again are both beneficial and injurious depending on locality and food-supply.

Improvements in agriculture such as are now going on, naturally tend (and will continue to do so) to the introduction of new varieties of crops into districts suitable for them, and in which as

yet they have not been grown. Now, a crop newly introduced into a district is grown experimentally at first, on small areas ; should these small areas be attacked by insects—and newly introduced crops often are so—the people of that district will conclude such crops are not worth taking up on a commercial scale, if most of them are to be grown to feed insects. Insecticides and practically-applied scientific measures can play an important part in checking insect-attack. Such measures are all importat on experimental areas and during sporadic insect-attacks ; but it is as well to bear in mind that natural checks are quite as important, if not more so. Natural checks are always there, always keeping the balance of life more or less even, and it is these we have to thank for limiting injury to crops and orchards to a very large extent ; they act as a continual check on injurious insects and insects which are generally regarded as harmless, but which may at any time change their habits somewhat to the injury of crops. These checks consist of parasitic and predaceous insects, animals, frogs, reptiles and, above all, birds. As man upsets the balance of nature by extending cultivated areas and by a more or less artificial production of crops, he lays himself open to attack from all sides, and must make as much use as he can of the help given him by nature against these attacks. (See Indian Insect Pests, Chapter V.)

From the most casual field observations, much can be learnt in a general way about the food of certain birds during some parts of the year. We can see Mynahs catching moths, crickets, etc., and eating maize, the Hoopoe probing the ground for caterpillars, the Rose Ringed Paraqueet pulling wheat and mustard to pieces and taking more than his share of lichis ; and many other similar notes can be made about these and other species of birds. It is therefore quite an easy matter to state that the food of such and such a bird consists of, say berries, beetles and grubs, and it is interesting to know such is the case. Such sweeping statements are, however, valueless to any one in a practical way except as showing vaguely what class of food a bird may be expected to take at certain seasons, and merely show how little is known about that bird's food. Scienti-

fically such information is practically valueless, and for all practical purposes can only be used as a doubtful basis for future work on the subject. But it must always be remembered that field observations, if first hand and made by capable men, are invaluable as a supplement to laboratory examination and determination of stomach contents of birds, and should be recorded whenever possible, however vague and useless they may appear.

In India, at present practically nothing is known about what birds do eat. From the economic point of view, the scientific identification of birds' food is of the utmost importance, and especially with regard to the insect portion. Economic Ornithology is, therefore, a sister science to Economic Entomology, just as much or perhaps even more so than Botany.

To aid agricultural interests, nature is called in practically and artificially, and every effort should be made to use such helps from every possible source. Wild birds are the source in question here. We should therefore know the value of every separate species of bird to man, *i.e.*, know what insects, what seeds, what fruits and other vegetable and animal materials are taken as food by birds at all times of the year under all conditions, climatic and physical. We can then, by encouragement of useful species and destruction of harmful ones, check the attacks of insects on crops, and enable the country to increase crop outturns, and in every way benefit agricultural and therefore the country's interests.

PART II.

With regard to their food, birds fall naturally into three main classes :—

I. Insectivorous.
II. Omnivorous.
III. Graminivorous or vegetarian.

Each of these three classes can, however, be sub-divided, but they are sufficient for practical purposes here.

I. *Insectivorous birds* are those whose food consists mainly of insects, and it is from this class that we expect, and get, more help than from the other two.

II. *Omnivorous birds*, strictly speaking, are those which eat everything and anything. Many of these prove beneficial, especially during the breeding season, whilst many are certainly more injurious than beneficial. We include here under this heading all birds not under headings I and III.

III. *Graminivorous* or vegetable feeders comprise some of the most injurious species and are of no use as a general rule. The sole benefit we can expect from these is in aiding seed distribution, in connection with forestry, and the possible destruction of a certain number of insects in wild fruits, which may at times make inroads on cultivated varieties.

Insectivorous Birds.

The sweeping statement is often made that because a bird is insectivorous, that bird is beneficial. This is in some cases absolutely wrong. Some birds will almost certainly be found to feed on beneficial insects only. How can these birds be beneficial ?

Again, many birds, entirely insectivorous, take more beneficial insects than injurious or harmless ones. How can these be beneficial? The beneficial action in destruction of injurious and harmless insects is more than counterbalanced by the injurious action in destruction of beneficial insects. Many birds will probably be found to take harmless insects only. I consider a bird that feeds on harmless insects to be beneficial. He keeps a check on undue proportion of these insects, and therefore prevents to some extent any likelihood of such insects making sudden inroads on crops, which might occur under abnormal or other climatic conditions. Again, a bird may consume vast quantities of injurious insects and yet by carrying eggs and larvæ from one place to another, act as the direct agent for spreading the attack of some insect pests. This is not beneficial action.

Agriculturally all insects fall under one of three definitely marked headings :—

I. *Beneficial and Useful—*

1. Act as checks on undue multiplication of other insect and plant life, which is injurious or likely to be injurious to agricultural interests, to stores and plant life.

Among these are included the Lady-bird beetles (*Coccinellidæ*) which control to some extent the attacks of Plant lice (*Aphidæ*); Ground-beetles (*Carabidæ*) and Tiger-beetles (*Cicindelidæ*) carnivorous. The *Ichneumonidæ* and other parasitic Hymenoptera. Many flies (*Tachinidæ, etc.*), also parasitic on caterpillars and other injurious insect life. Dragon-flies (*Odonata*), Ant-lions (*Myrmeleo*) and Lace-wing flies (*Chrysopidæ*), all carnivorous.

Some *Hemiptera* or bugs suck out juices from caterpillars, etc., and kill them.

2. Play a considerable part in the fertilisation of flowers. Bees (*Apidæ*), and possibly many other forms.
3. Live on animals and plants to the benefit of their hosts *Mallophaga* (?)

4. From which some valuable marketable product is obtained :—Silk, honey, wax, lac, dye, &c.

Silk from various members of the Saturniadæ—esp. *A. ricini*, and *A. paphia*—and Bombycidæ—*Bombyx mori*.

Honey and wax from bees (*Apidæ*).

Lac and dyes from one or two members of the scale insects (*Coccidæ*).

II. *Injurious*—

1. Disease carriers to animals.

Mosquitoes, Fleas. (*Culicidæ* and *Siphonaptera*.)

2. Destructive to crops, forests, stored grain, fabrics, timber and food stuffs. Insects destructive to crops are various and cause damage in a number of ways. Caterpillars eat leaves and bore into the stem and roots, various beetles such as the *Chrysomelidæ* are defoliators and the larvæ of others tunnel into twigs and stems such as *Buprestidæ* and *Curculionidæ* of various species. *Aphidæ* and other *Hemiptera* suck out the juices of plants.

Stored grain and food stuffs are attacked by many well-known pests such as the Rice Weevil, and many other beetle and moth larvæ.

Forests and timber by various wood-borer larvæ (*Coleoptera* and *Lepidoptera*) the former too often by defoliating caterpillars.

Fabrics by clothes moths, wood-boring beetles and others.

III. *Harmless or neutral*—

These insects that cannot be classed as either beneficial or injurious. This class contains by far the larger proportion of insect life, but vast numbers of which, if adopting the same habits as are seen in others of the same families and genera, may become pests, and especially if imported into other countries without their natural enemies.

The most important groups of insects we have included under this heading are the Ants (*Formicidæ*) and the Dung beetles (*Scarabæidæ*). These two groups are exceedingly numerous both in species and individuals and form an important item in the food of most of the insect-eating birds.

The economic importance of orders and families, etc., of insects mentioned in this paper, as taken by birds, is separately discussed or stated on page 346.

Vegetarian and Grain-eating Birds.

As a general rule, it is among purely seed and fruit-eating birds that injurious species will occur. A purely fruit-eating bird can never be regarded as beneficial, except from a forestry point of view. Seed-eating birds, that eat weed seeds only, are as a rule said to be beneficial. On the whole, perhaps they are, though there are arguments against this. It is a well-known fact that birds act as a natural means for seed distribution, that the germinating power of seeds is often not injured in the least by passing through the bird, and that many seeds (e.g., *Loranthus* spp.) are specially adapted for this method of distribution; and again many species of birds have the power of ejecting from the mouth both distasteful food and also hard seeds when the pulp surrounding them has been digested. Such birds, therefore, though destroying many seeds, distribute others further afield than would otherwise have been the case and are injurious rather than beneficial, except from a forestry point of view. In India, I consider a bird eating weed seed as of no value whatever. They may keep weeds down to a certain extent, but this is of minor importance in a country where labour is cheap and where farming is not practised on such intensive lines as elsewhere. Even in intensive cultivation we cannot rely on weeds being kept down by birds and the expense of cultivation to eliminate weeds is, I believe, not reduced in the slightest by the action of birds. We cannot expect the complete elimination of any one of the commoner weeds by the agency of birds alone. If

any species of bird fed almost entirely on one species of weed and there seemed to be every possibility of that weed being eliminated, the bird, finding its food-supply diminishing, would migrate. It is a proved fact that the presence of at any rate a fair number of species of birds in certain districts is to a large extent regulated by food-supply. And again, many birds eating weed seed will take a considerable amount of grain from standing crops and seeds from seed crops in many instances.

Omnivorous Birds.

Omnivorous birds are both insect and vegetable feeders, and their diet also contains various other forms of food. This group as here arranged contains all birds which cannot be classed with insectivorous or vegetable feeding birds. It could well be subdivided into two or three specialised groups, as shown on page 26.

Animal Diet other than Insects.—This class of food, together with insects and grain, comprises the food of omnivorous birds. This forms a large proportion of the food of many birds, often comprising the total food of some species. In many instances, however, birds taking such food will also have a portion of their diet composed of insects or vegetable material. Such diet comprises the following :—

Mammals which the bird either eats as carrion, or else kills itself, birds, frogs, reptiles, fish, mollusca, crustacea, spiders, excreta and offal.

Mammals.—Hawks and owls are practically the only classes which take mammals for food, though there are others that do so occasionally, such as shrikes, rollers, etc., and these cannot be regarded in most cases as injurious if so doing: a few kids and lambs may be taken, and if so the individual bird that does so can be destroyed. In some few cases too, small beneficial mammals such as shrews are taken. Otherwise these classes of birds are beneficial and need protection only from skin and egg collectors. They will not, as a rule, be destroyed for plumage, and certainly not for food. Many hawks and owls feed extensively on large insects also, principally Orthoptera, and Lepidopterous larvæ.

Frogs, Lizards.—Birds which eat toads, frogs, lizards (and snakes ?) are undoubtedly injurious in this respect, hawks and owls especially. The amount of insects a frog can eat is enormous; the variety of insects he takes is astonishing: he is practically an exclusive insect feeder, limited only by stomach capacity. A frog knows to a nicety how large an insect he can get outside of. Frogs and toads are recognised as one of the best methods for keeping greenhouses and gardens free from insects. They seem particularly partial to grasshoppers and ephemerids, but moths, ants and beetles of every description do not come amiss. They have been seen also to take small millipedes. Toads are said to take bees from the hive, but this can easily be prevented by practical measures adopted by the bee-keeper. Lizards are a little more fastidious; they prefer moths and flies to anything else. They undoubtedly take beneficial insects as well, but in spite of this they must at present be considered beneficial. Anyone who watches the common house lizards of India cannot help noticing that beetles, and other hard insects, are carefully left alone, and that they seldom touch ants. The common small hemiptera or stink-bugs (*Cydnus*), so common round our lamps in the rains, are also carefully left alone. I saw a young lizard take one once. He did not seem to like it and retired behind a book on my writing table most probably to get rid of it. He has not taken one again, though not for want of opportunity.

Spiders, Fish, Molluscs, Crustacea, etc.—Some birds take spiders, but to no great extent, not enough to be regarded as injurious from that cause alone, though a habitual spider-eater is injurious. Fish and mollusc-eating birds are of no importance generally in India; when they are injurious, which would be very locally, they can be destroyed. Mollusc and snail feeders are at any rate, if not in India, beneficial in other countries, especially with regard to the checking of liver fluke in sheep.

Birds.—Birds which prey on other birds do a considerable amount of good and at the same time harm. No doubt many birds of no economic value are taken, and also even if the birds taken

are beneficial, in very many cases they will prove to be diseased or weak ; this destruction being then a benefit to the species. Again, many will be taken if abnormally coloured, the bird of prey being the aid therefore in that natural selection which protects so many forms of life from their foes. Young poultry suffer to some extent from ravages by birds of prey, as well as from rats, mongooses and snakes. These birds can be kept off to a large extent if not allowed to breed in the vicinity, a fact already recognised by natives in some parts of the country. It is during the breeding season that ravages on poultry will mostly be committed by birds. On the other hand, there are numbers of birds which take nestlings and eggs from smaller species ; while others will turn out some from their nests (*e.g.*, sparrows turn out martins) when they have built them, and use the nest for themselves, so harrying these that nesting, and therefore normal reproduction, are greatly interfered with and checked. Both these cases, namely, destruction of young and eggs of other birds and usurping their nests, should tell heavily against the bird that does so, provided that the species the eggs belong to, and the birds turned out of their nests, are of beneficial economic importance. When considering, therefore, the economic importance of any one species of bird from its food only, we realise how complex a subject this is, and how much must be learnt about the bird under all conditions of life before definite measures for protection or otherwise can be adopted.

Some birds are undoubtedly injurious to crops, etc., for part of their lives, but before they can be classed as injurious their feeding habits for the rest of their life must be carefully observed.

As an instance of the above point, the Rosy Pastor (*Pastor roseus*) is an excellent example combining both a marked beneficial and a marked injurious action at different seasons. In some part of the year it will, if allowed, do an immense amount of damage to jowari when ripening ; at another the numbers of locusts it destroys is enormous, and it also acts as an agent for limiting the damage of locusts since by continuous persecution of these insects, it drives them from one locality to another, thereby spreading the

damage over a larger area. It is (and probably will remain so) a much debated question as to whether damage to jowari or the destruction of locusts is the most important factor.

A bird injurious to a crop may do harm to that crop in various ways, but this damage may be entirely counteracted by the bird's other feeding habits, especially during the breeding season, when it will be found in some cases that vast quantities of caterpillars are fed to the young. And again, owing to the construction of the stomachs of young birds, caterpillars are often fed to the young of birds which, when mature, are almost purely grain-eating. The stomach of young birds is not so powerful as that of older birds in most species, and therefore needs softer food. We commonly hear or see it stated that a bird is a pest, and should be kept down in numbers, because it has been observed to damage fruits, vegetables, and so forth. The informant totally ignores what form of food has been taken by this bird during the rest of the year. It will, as often as not, be found with careful observation that the food then consists of insects, many of which are injurious, slugs, etc., and the conclusions arrived at and stated, from one or two casual field observations, are exactly contrary to the real facts of the case.

It is also important to note that the breeding season of most birds common in the plains takes place during the cold weather and the earlier part of the hot weather. It is during this time that the first broods of a number of our caterpillar pests appear. A check on these insects before they have had time to multiply to any extent is all-important, and this check will be given provided we have the birds on the spot to give it. Many birds, such as crows, apparently feed little on caterpillars until these insects have become very numerous, in fact, when they are swarming, and any number eaten at that time does little good, certainly very little in comparison to that done by a bird that feeds on them habitually. A bird that eats a few swarming caterpillars in the first broods, and when they have not reached any serious proportions, does infinitely more good than if the caterpillars were only taken when they were noticed to be swarming, even if at the latter time these caterpillars formed

the sole food of that bird. At the latter time the damage is done, while if some caterpillars are eaten in the early broods, for every one eaten then, thousands, that would otherwise have appeared later in the year, are non-existent. It is, therefore, obvious that a bird that feeds habitually on injurious insects is of far more economic value than another bird whose diet varies according to food-supply. Every bird's food must vary somewhat according to food-supply, and we, therefore, speak in the sense applicable to the above.

One often hears that great authorities on birds refuse to give an opinion as to whether partially insectivorous or omnivorous birds should be encouraged and protected, and with very good reason. Birds can in some cases increase with extraordinary rapidity, and if encouraged, it is surmised that insect-life—of which there is abundance in India at present—would rapidly decrease; birds being unable to find food elsewhere, would then undoubtedly attack crops. This theory might very possibly prove correct, but until it is put into practice, no one can foretell definitely what would happen. In considering this question the following points should always be borne in mind. The theory advanced above can have no application to birds not indigenous to the country, or rather to birds which may have been recently imported. Now, a bird, provided that it is a resident species, is undoubtedly a far easier thing to destroy than many insects, in spite of the fact that most insects destroyed by birds are also those most readily destroyed by science applied in a practical manner, and should the bird prove the theory advanced above, that bird could be checked after its beneficial work was done. With migratory species it is a very different matter. Should birds be protected and encouraged, they may exterminate certain insects, amongst which some crop pests would certainly occur, and as likely as not some parasitic insects as well. But enough is now known and more will shortly be known about importation of insect parasites to render that importation a safer procedure and more reliable than formerly.

In considering the whole question of economic ornithology every point for and against the bird in question must be carefully

balanced. Impartiality, not personal opinion, is essential. Personal opinions can but apply to very local conditons in most cases, and must be avoided. All sentimental ideas about protection of beautiful species or song birds must be totally ignored. It must always be borne in mind, however, that in no case do we wish to see any one species totally exterminated.

In all probability, when we know enough about the food of birds, it will be found that comparatively few can be considered as actually beneficial or harmful; by far the greater number coming under a neutral heading. Many will be found to do damage to crops, fruits, etc., locally only, and so to need local check and not a general one. Even this classification may, however, need modification under different local conditions. It is, therefore, exceedingly difficult to state anything definite about birds which can apply generally throughout India. We can certainly advise nothing until we have sufficient information from all the chief districts in India.

The whole question of economic ornithology is, at present, a very doubtful one. It may be that in countries where no protection exists and where birds of all kinds are ruthlessly persecuted, we hear of no more insect plagues than in countries which afford protection to some of these birds. This may perhaps hold good in a temperate climate. I believe this does not apply in the least to India and other hot climates, where insect life is so abundant, and where it can and does increase so abnormally under certain conditions.

In the study of the food of birds, mention must be made of caged birds. Of birds kept under these conditions little, if any, information of value can be obtained, so long as the food has to be provided for these birds. If we know what the food of a certain species is in the wild state, we can then by caging some birds of this species form a vague idea of the proportion of, and preference shown for, certain kinds of food; we can get very little real idea as to the quantity. If the natural food is but vaguely known, we learn practically nothing by this method. The only real application of this method of any value—and it is of great value when possible for

furthering our knowledge of the food of nestlings—is to obtain and cage a clutch of young birds, so placing them that the old birds will come and feed the young. We can then identify accurately what food is fed to the young in definite proportion, and in fact get a full and accurate idea as to what the nestlings are brought up on until they can leave the nest, or obtain food for themselves. This method is, however, only practicable occasionally, and with but few species of birds. The food of nestlings is a very important item of economic ornithology. A definite study of the food of nestlings is required of each species, just as much as that of the food of adults.

Summary.

In the study of economic ornithology it is essential to know practically everything about the bird with which we are dealing. The food of every different species of bird under every condition throughout the year is of primary importance, and the food of the nestling is an important item under this heading. All foods (insect, vegetable or otherwise), must be identified scientifically whenever possible or necessary. Field observations are invaluable as a supplement to laboratory examinations, and bring to light many details we cannot obtain in a laboratory, even with regard to the food of birds.

We must know localities, life-history and habits of all species, including especially where, when, and how often birds nest during the year, their methods of feeding, migration, if any, etc.

We must consider carefully and impartially every point with regard to each species, their beneficial, injurious and neutral feeding qualities, and their general utility, if any, to man.

Finally, we must know how we can best protect and encourage beneficial species, and how to get rid of, or diminish the numbers of, injurious species in the most effective and practical manner.

Method of Stomach Examination, etc.

The examination of the birds' stomachs I have collected has been done on very similar lines to those adopted by Mr. Newstead

and described in the supplement to the Board of Agriculture Journal for December 1908.

The stomachs* are cut open as carefully as possible so as not to injure the contents, which owing to partial digestion are, as a rule, very liable to break up, and so, in the case of insects especially, rendered much more difficult to identify. The stomachs are then immersed in water, and the contents washed out into a white saucer or—what is still better—a white porcelain photographic developing dish ($\frac{1}{4}$ plate size is the best for the smaller stomachs). The larger and more easily identifiable portions of the food material are then removed one by one, identified, and tabulated. All the unidentifiable material is placed in bottles containing a weak solution of spirit or formalin, or in the case of seeds is dried and then put up in glass tubes. If the stomach contents do not wash out readily, it is best to scrape them out with a needle: a brush should not be used, as with it insects are far more likely to be broken, and one cannot see what one is doing nearly so well. After all the readily identifiable material has been removed and noted, the water is run off the dish, none of the material being allowed to escape, and clean water is added. This is not necessary in the case of the stomachs of the smaller birds, but is so with the larger ones and especially if omnivorous, these latter always containing a large percentage of semi-digested animal and vegetable matter. The rest of the food is then treated and examined as described above. In the case of the smaller birds it will often be found necessary to examine the food or portions of it under a glass, and a magnification of 10 is quite sufficient for the purpose.

Stomachs should be examined as soon after they have been obtained as possible. It is always a difficult matter to identify a great deal of the contents of the stomachs, and if they have been kept for any time in spirit, identification is still more difficult. This is especially the case with caterpillars and any food material that may have colouring matter in it, as this is usually destroyed by the

* Here as elsewhere in this paper with reference to my own notes, the word 'stomach' is used to denote the whole alimentary canal, and not the crop and gizzard only.

spirit. The stomachs too become hard, and there is therefore a greater risk of breaking the contents when the stomachs are cut open.

It will be noticed that in many instances in the records the following kind of note is made after many insects of which, as a rule, only the family or sub-family is stated (Pusa No. 25). This number refers to the number of the insect in the Pusa collection, the name having as yet not been definitely determined. In the case of some of the seeds unidentified, numbers are also placed against them referring to seeds I have numbered and put up in a reference collection of seeds taken from birds, the collection being at present in the laboratory of the Imperial Entomologist.

In recording the materials forming the food found in the stomachs I have examined, the number of insects of each species, the number of seeds, etc., has been recorded as nearly correctly as possible. Every insect and part of an insect or other food material found in the contents must be carefully examined in order to determine the species if possible and therefore there is no extra work entailed or time spent in making these tables; we have too the total contents of the stomachs in a tabular form, which may be of use to anyone who has not the same ideas as to the economic importance of the insect food as is here stated.

I have made no statements in a general way as to the relative bulks of the food taken. We see it stated repeatedly that relative bulks of food taken by birds are very important in any conclusion that we may wish to draw from economic entomology. This is an extremely difficult point to settle and can only be obtained after the most careful study of the question. From stomach examinations in the laboratory we can learn very little indeed about proportion in which the foods are taken, and our only method for obtaining this end practically consists of a complete study of the food of the birds, from specimens obtained throughout the year under all climatic, physical and seasonal conditions and even at different times during the day (this latter point is certainly one of importance in some birds and possibly therefore in most). When we have these

laboratory records, we can compound them with the figures we have obtained in field observations and draw our conclusions.

Comparative bulks of foods, if expressed merely as percentages, are of absolutely no value whatever, and cannot give any idea as to the true economic ratio of the food of the bird in question. What we want to know is the exact number of grains of corn, the number of insects, etc., taken, and we must not draw our conclusions from a small number of records nor from a mass of records that have been accumulated at one season of the year only. We must take a fair average. We must consider the economic importance of each item of food taken, whether the grain is of value being taken from standing crops or otherwise, and whether the insects and other animal and vegetable food are of any importance, and if so what and to what extent. We can then obtain a definite ratio between the economic value of the various foods eaten, and from it draw conclusions definitely as to whether the species of bird in question can be regarded as beneficial or otherwise.

LIST OF BIRDS EXAMINED.

Fauna of India No.	Name of Bird.	No. of specimens.	Page.
4.	Corvus macrorhynchus	37	29
7.	Corvus splendens	49	32
16.	Dendrocitta rufa	13	40
31.	Parus atriceps	10	46
110.	Crateropus canorus	36	51
226.	Zosterops palpebrosa	15	58
243.	Aegithina tiphia	6	60
282.	Molpastes bengalensis	37	63
321.	Sitta castaneiventris	9	68
327.	Dicrurus ater	62	69
374.	Orthotomus sutorius	4	81
381.	Cisticola cursitans	5	82
404.	Phylloscopus affinis	1	83
407.	Do. tristis	12	83
410.	Do. fuscatus	7	83
417.	Do. superciliosus	1	84
421.	Acanthopneuste nitidus	1	84
422.	Do. viridanus	2	84
476.	Lanius erythronotus	1	87
488.	Tephrodornis pondicerianus	7	88
500.	Perecrocotus peregrinus	4	88
510.	Graucalus macii	3	89
518.	Oriolus kundoo	13	90
521.	Do. melanocephalus	23	92
528.	Pastor roseus	6	95

LIST OF BIRDS EXAMINED—(*continued.*)

Fauna of India No.	Name of Bird.	No. of specimens.	Page.
538.	Sturnia malabarica	7	99
549.	Acridotheres tristis	35	101
551.	Do. ginginnianus	8	106
555.	Sturnopastor contra	15	108
562.	Siphia albicilia	12	111
592.	Culicicapa ceylonensis	1	113
598.	Terpsiphone paradisi	3	113
644.	Ruticilla rufiventris	5	115
647.	Cyanecula suecica	3	116
666.	Copsychus saularis	12	117
686.	Geocichla citrina	2	120
698.	Oreocincla dauna	1	121
720.	Ploceus baya	7	122
734.	Uroloncha malabarica	11	123
735.	Do. punctulata	3	124
775.	Gymnorhis flavicollis	12	126
776.	Passer domesticus	8	127
809.	Cotile sinensis	1	131
826.	Motacilla alba	10	131
829.	Do. personata	7	132
833.	Do. borealis	3	133
835.	Motacilla beema	4	134
841.	Anthus maculatus	67	134
847.	Anthus rufulus	4	136
863.	Calandrella dukhenensis	53	137
871.	Mirafra erythroptera	3	141
895.	Arachnechthra asiatica	14	142
919.	Dicæum erythrorynchum	9	144
972.	Liopicus mahrattensis	3	147
976.	Iyngipicus hardwickei	3	147
983.	Micropternus phæoceps	3	148
986.	Brachypternus aurantius	16	148
1003.	Iynx torquilla	8	151
1008.	Thereiceryx zeylonicus	44	153
1019.	Xantholæma hæmatocephala	15	154
1022.	Coracias indica	18	155
1026.	Merops viridis	43	160
1027.	Do. philippinus	13	164
1033.	Ceryle varia	5	167
1062.	Lophoceros birostris	6	170
1067.	Upupa indica	24	171
1093.	Caprimulgus macrurus	3	178
1107.	Cuculus micropterus	1	180
1109.	Hierococcyx varius	17	180
1118.	Coccystes jacobinus	4	182
1120.	Eudynamis honorata	15	183
1129.	Taccocua leschenaulti	1	184
1130.	Centropus sinensis	5	184
1138.	Palæornis torquatus	53	188
1139.	Do. cyanocephalus	7	189
1152.	Strix flammea	1	191
1180.	Athene brama	8	193
1196.	Gyps bengalensis	..	196
1220.	Butastur teesa	17	202
1228.	Haliastur indus	10	205
1229.	Milvus govinda	13	207
1244.	Astur badius	6	210
1249.	Pernis cristatus	4	212

LIST OF BIRDS EXAMINED—(*continued.*)

Fauna of India No.	Name of Bird.	No. of specimens.	Page.
1271.	Crocopus phœnicopterus	111	217
....	Columba intermedia		218
1307.	Turtur suratensis	6	219
1310.	Turtur risorius	19	220
1311.	Œnopepelia tranquebarica	2	221
1372.	Francolinus vulgaris	30	235
1384.	Turnix tanki	10	248
1401.	Amaurornis phœnicurus	5	252
1417.	Sypheotis bengalensis	2	260
1418.	Oedicnemus scolopax	3	262
1429.	Hydrophasianus chirurgus	2	264
1431.	Sarcogrammus indicus	9	264
1435.	Hoplopterus ventralis	8	265
1447.	Aegialitis dubia	1	265
1461.	Totanus glareola	24	267
1462.	Totanus ochropus	10	268
1464.	Totanus calidris	2	269
1471.	Tringa minuta	3	270
1484.	Gallinago coelestis	12	271
1503.	Sterna seena	1	275
1528.	Phalacrocorax javanicus	7	278
1542.	Inocotis papillosus	2	280
1555.	Ardea cinerea	1	284
1565.	Ardeola grayi	4	286
1593.	Anas poecilorhyncha	3	294
1601.	Querquedula circia	2	297

With regard to the classification of birds according to their food, I cannot do better than quote in full a paper by W. L. Sclater (I. M. N., Vol. II, 117-121), which not only gives a classification of the birds of India according to their food in a generalised form, but also supplies much interesting and, from an economic point of view, valuable information.

The only essential alteration necessary is that of substituting the word "mainly" for "purely" in the heading of "purely insectivorous" birds. This is no doubt what the author meant, for no one could class most of these families as purely insectivorous: they are mainly insectivorous certainly, but of those thus grouped it is generally known that the Shrikes [Laniidæ] are partially carnivorous, eating both lizards and small birds: that the Ground Cuckoos [Cuculidæ] have a very mixed diet and should possibly be included as omnivorous, and that the Koel and one or two other species of cuckoos entirely or partially exist on fruit only; that Rollers [*Cora-*

ciadæ] take mice, etc. Frogs have also been found to form some part in the food of the common Babbler [Crateropodidæ]; the King-crow [Dicruridæ] eats worms and spiders, and so forth.

From the "purely insectivorous" birds we must undoubtedly transfer the Motacillidæ to the group containing birds of mixed diet. Wagtails have been found to take grain from near stables (whether these grains were taken in mistake for other food has nothing to do with the question here) and Pipits feed often very largely off weed seeds and vegetable matter and are by no means qualified to be called mainly insectivorous birds. If we are to place the Cuculidæ in any other group, and their food as a group is far too varied to be called insectivorous, we must place them as omnivorous. This is a far more satisfactory classification and more correct.

In the present paper it will be noticed that birds are subdivided into three headings only:—

Insectivorous.—Birds that eat insects mainly, that is, insects form the greater part of their food.

Mr. Sclater's purely insectivorous birds come under this heading.

Graminivorous and Vegeturian.—Birds whose diet consists mainly of vegetable matter or entirely so.

Mr. Sclater's frugivorous birds come under this heading.

Omnivorous.—Birds that have a mixed diet, though they may not be strictly omnivorous. Few birds are so.

Mr. Sclater's birds of mixed diet, birds which live in or about water and wet places, carnivorous and omnivorous, are all included in this group.

'The Economic Importance of Birds in India.'

"Birds may be economically considered in two very different ways: firstly, from the direct point of view of the economic products of the birds themselves; secondly, from the indirect point of view of the benefit derived from the destruction of noxious insects by birds which, no doubt, is of very great importance to agriculture.

"It has been argued by certain people, interested in agriculture, that insectivorous birds, which are so directly important as insect pest destroyers, should be protected by law, but the question arises as to whether insectivorous birds are destroyed for their direct products in any quantities which would make it worth while to introduce special legislation for their protection. In considering this question, the first thing to do is to find out what birds are destroyed in any large numbers in India.

"There are only two purposes for which this is done :

1. For the sake of their skins or feathers, which are exported in considerable quantities.
2. For eating purposes.

The following are the principal birds killed for their skins and feathers :—*Herodias alba*, *Herodias intermedia* and *Herodias garzetta* (Egrets), all of which have in the breeding season a dorsal or pectoral train of what are known as decomposed feathers ; that is, feathers whose barbs are not connected with one another. These feathers are sold and exported in very large quantities and fetch very high prices.

"Other birds of the heron family such as *Buphus coromandus* (the Cattle Egret) *Ardeola leucoptera* (the Pond Heron), *Ardea cinerea* (the Blue Heron), all produce feathers which are sold in large quantities but not at such high prices as those of the egrets proper.

"Another bird whose feathers have a certain market value is the Indian Snake Bird [*Plotus melanogaster*]. The lengthened scapular feathers, which are the only ones sold for export, are also, according to Jerdon, 'looked on as a badge of royalty by the Khasias, and were once the badge of one of the Bengal regiments of Irregular Cavalry.'

"Many of the pheasants are exported in large quantities, more especially the Monaul [*Lophophorus impeyanus*]. The bulk of the specimens of the pheasants brought down to Calcutta are shot, I believe, in Bhutan and Nepal, and I have been offered as many as a thousand skins at once. The other pheasants occurring in any quantity likely to be exported are the two species of *Ceriornis*

(*C. satyra* and *C. melanocephala*) known as the Sikkim and Simla Argus Pheasants respectively, though, of course, they are neither of them the true Argus, which is a bird found in the Malay Peninsula only.

"The only other birds which to my knowledge are exported in any quantity are the common species of the genus *Palæornis* to which all the Indian parrots belong, the Blue Jay or Roller (*Coracias*), the King-fishers (*Ceryle* and *Halcyon*); and the jungle fowls (*Gallus*). The heckles of the southern jungle fowl (*G. sonnerati*) are used for making fishing flies among other things.

"For the following list of the birds commonly eaten in India, I am greatly indebted to Mr. Hume's Gleanings from the Calcutta markets (Stray Feathers, Vol. VII, p. 479), which not only gives the birds brought to the market in Lower Bengal, but which is also more or less applicable to the whole of India :—

Charadrius fulva	Golden Plover.
Gallinago stenura	The Pin-tailed Snipe.
Gallinago gallinura	The Common Snipe.
Totanus glareola	The Spotted Sand-piper or Snippet.
Totanus calidris	The Red-shanks or Snippets.
Hydrophasianus chirurgus	The Pheasant-tailed Jacana.
Nettopus coromandelianus	The Cotton Teal.
Chaulelasmus streperus	The Gadwall.
Dafila acuta	The Pintail.
Fuligula rufina	The Redcrested Pochard.
Fuligula nyroca	The White-eye.
Querquedula circia	The Blue-winged or Garganey Teal.[1]

"The following are the birds commonly eaten when shot by European sportsmen throughout India, but are not found anyhow commonly in the Calcutta bazaar :—

Crocopus phœnicopterus	Hurrial or Green Pigeon.
Columba intermedia	Kabutar or Blue Rock pigeon.
Eupodotis edwardsi	Tokdar Sohan or Bustard.
Syphcotides bengalensis	Charras or Florikin.
Grus antigone	Sarus or Sarus Crane.
Ciconia leucocephala	Manikjor or Beef-steak bird.
Calandrella brachydactyla	Baghaira or Ortolan.
Pterocles exustus	Kuhar or Sandgrouse.
Pavo cristatus	Mor or Peacock.
Gallus ferrugineus	Jungli Murghi or Jungle Fowl.
Gallus sonnerati	Gray Fowl.
Galloperdix spadiceus	Red Spurfowl.
Francolinus vulgaris	Kalatitar or Black Partridge.

Francolinus pictus	Painted Partridge.
Ortygornis gularis	Bantitar or The Kyah Partridge.
Coturnix communis	Batter or Gray Quail.

"But in a country such as India, where an enormous percentage of the inhabitants are purely vegetable feeders, the number of birds killed for the table (except, perhaps, in the neighbourhood of great towns, such as Calcutta) is insignificant. Of all the birds mentioned in the above list, both killed for their plumage and their flesh, hardly one can be called an insectivorous bird.

"The food of the Herons and Egrets consists entirely of fish and frogs; the Cattle Egret perhaps devours a few grasshoppers, but the bulk of the food consists of fish and tadpoles; the Snake Bird is entirely piscivorous.

"Pheasants only occur at considerable elevations in the Himalayas; they are chiefly vegetable feeders, though now and then they may devour a few insects.

"Parrots are all fruit eaters and do considerable damage in this way. Neither Snipe nor Ducks are insectivorous in a true sense of the word.

"The following is a list of the purely insectivorous birds:—

Paradoxornithinæ	Crow-tits.
Crateropodinæ	Babbling Thrushes.
Timeliinæ	Solitary Babblers.
Brachypteriginæ	Ground Babblers.
Liotricinæ	Ioras and Green Bulbuls.
Dicruridæ	Drongos or King crows.
Certhiidæ	Creepers.
Sylviidæ	Warblers.
Laniidæ	Shrikes and Minivets.
Muscicapidæ	Fly-catchers.
Saxicolinæ	Chats.
Ruticillinæ	Redstarts and Robins.
Accentorinæ	Hedge Sparrows.
Hirundinidæ	Swallows.
Motacillidæ	Wagtails and Pipits.
Pittidæ	Ground Thrushes.
Cypselidæ	Swifts.
Caprimulgidæ	Goatsuckers.
Picidæ	Woodpeckers.
Upupidæ	Hoopoes.
Meropidæ	Bee-eaters.
Coraciadæ	Rollers.
Trogonidæ	Trogons.
Cuculidæ	Cuckoos.

"The following are the birds of mixed diet, partly insectivorous, and partly fruit and grain eaters in varying proportions :—

Parinæ	Tits.
Sibiinæ	Sibias, White-eyes, &c.
Brachypodinæ	Bulbuls.
Sittidæ	Nuthatches.
Oriolidæ	Orioles.
Sturnidæ	Starlings and Mynahs.
Turdidæ	Thrushes.
Fringillidæ	Finches.
Alaudidæ	Larks.
Nectariniidæ	Sun-birds.
Dicæidæ	Flower-peckers.
Phasianidæ	Pheasants.
Tetraonidæ	Partridges.
Turnicidæ	Button Quails.
Rallidæ	Rails.
Gruidæ	Cranes.
Otididæ	Bustards.
Limicolæ	Waders of all sorts.

"The following are the birds which live either in or about water and wet places; their food consists of fish, frogs and tadpoles, aquatic larvæ of insects, and such small animals as fresh-water crustaceans :—

Cinclinæ	Ouzels.
Halcyonidæ	King-fishers.
Phalacrocoracidæ	Cormorants.
Pelecanidæ	Pelicans.
Ardeidæ	Herons and Egrets.
Tantalidæ	Ibis.
Anseres	Ducks.
Laridæ	Gulls and Terns.

"To complete the list of birds I have divided the rest of them into the following three groups :—

Carnivorous	Striges	Owls.
	Accipitres	Vultures and hawks.
Omnivorous	Corvinæ	Crows.
	Ciconiidæ	Storks.
Frugivorous	Eulabetidæ	Hill Mynahs.
	Ploceidæ	Weaver birds.
	Bucerotidæ	Horn bills.
	Capitonidæ	Barbets.
	Psittacidæ	Parrots.
	Columbæ	Pigeons.
	Pteroclidæ	Sand grouse.

"From the above lists it will be seen that few, if any, of those in the list of purely insectivorous birds are to be found among the birds mentioned in the first part of the paper, *i.e.*, those destroyed for plumage or food. With regard to those of a mixed diet given in the other lists, it would certainly be inadvisable to protect them, since they may do much greater harm in devouring fruit and grain than they do good in destroying insects; such is especially the case with crows and starlings.

"With regard to the time of breeding, most small birds in Upper India at any rate breed between April and July. Of course, there are many exceptions; but the four months—April, May, June and July—would practically cover the breeding time of nearly all the birds which require protection.

"In Southern India many birds breed in December and January, and in the hills the breeding season, as for instance, in the case of the Monaul, is in July and August. In the case, however, of Lower Bengal, the best months are undoubtedly April, May and June." [Indian Museum Notes, Vol. II, 117-121].

For further information with regard to feathers used for ornaments, etc., reference should be made to Watt's Dictionary of Economic Products, the Report from the Select Committee of the House of Lords on the Importation of Plumage Prohibition Bill (13-7-08), Dr. Forbes Watson's List of Indian Products, etc. It is also interesting to note that the tail-feathers of the Racket-tailed Drongos and the brighter coloured feathers of the Hornbills are used in head-dresses by some hill tribes in Assam, etc., and that the beak of the larger Hornbills is also said to be used for carving work.

THE FOOD OF BIRDS.

In the following pages, the birds are considered in order, following the volumes of the Fauna of India and using the numbering and nomenclature there adopted.

Passeres.

Corvidæ.

The *Corvidæ* are divided into the following sub-families :—

Corvinæ, Parinæ and *Paradoxornithinæ.*

They are the most omnivorous of all birds : they eat all kinds of food, from carrion to grain. Jer. B. I., I, 292.

Corvinæ comprise Crows, Magpies, Jays, Nutcrackers and Choughs. Speaking of *Corvinæ* (Crows and Magpies) Jerdon (B. I., I, 292) says : "Crows live on all kinds of food : may be seen eating carrion with vultures ; eating winged Termites with Fly-catchers and Bee-eaters, fishing with Gulls and Terns at the wake of a ship, plucking fruit with Green Pigeons and Cuckoos, or eating grain with Sparrows and Weaver-birds. "

"The majority feed habitually on the ground, others are strictly arboreal..... Most of them are omnivorous, but some of the smaller tropical species appear to confine their diet to insects." F. I., I, 11.

"The *Corvidæ* are almost omnivorous, Ravens and other strong species even attacking weakly ewes or lambs and preying on small mammals, birds and reptiles. Hooded and Crion Carrows, Rooks, Magpies, Jackdaws and Jays suck eggs ; while Rooks, though undoubtedly beneficial, also grub up seed corn and potatoes. An immense amount of insect-life is, however, destroyed and the larger forms dispose of carrion.... Magpies and Jays feed largely upon the ground and eat slugs, snails, worms, insects, nuts, acorns, grain, seeds of conifers and other fruits. Nutcrackers devour quantities of the last.... Jays store provisions and Jackdaws pick insects off cattle." E. B. C. N. H., 556.

Corvus : very predaceous and carnivorous. Jerd. B. I., II, 293.

Ravens : Pigeons, pigeons' eggs, hares, chucor : trained for hares. J. A. S. B., 1907, III, 116.

4. *Corvus macrorhynchus*, Jungle Crow.

29–1–09.	Flower of *Bombax malabaricum*.
2–2–09.	Flower of *Bombax malabaricum*.
2–2–08.	3 *Myllocerus discolor*.
	Flower of *Bombax malabaricum*.
12–2–08.	Flower of *Bombax malabaricum*.
4–3–07.	6 *Catharsius sabæus*.
	Grass and weed seeds.
12–3–08.	Potato peelings, bits of onion, fat, etc.
	2 small worms.
12–3–08.	17 Oats.
12–3–08.	96 Oats.
12–3–08.	123 Oats.
12–3–08.	84 Oats.
14–3–08.	4 *Chrotogonus sp.*
	19 Oats.
	A few leaves and shoots.
26–3–09.	5 *Catharsius sabæus*.
	1 *Monophlebus stebbingi*, female.
	1 *Ficus* sp. fruit.
	4 or 5 blades of grass.
1–4–07.	1 Centipede.
	4 Oats.
	12 Wheat grains, other vegetable matter.
1–4–08.	Stomach empty.
	Alimentary canal contained the remains of kitchen scraps only.
1–4–09.	1 *Onthophagus spinifer*.
	1 Ber fruit ? (*Zizyphus jujuba*.)
	1 Piece of brick.
	1 Piece of bone.
	Several small sticks.
6–4–08.	5 *Catharsius sabæus*.
	2 *Onthophagus* sp.
	Some *Ficus* fruit remains.
12–5–08.	Stomach almost empty.
	Vegetable remains only.
12–5–08.	Stomach entirely empty; alimentary canal contained a few oat husks.
21–5–08.	2 Centipedes.
	Vegetable and other refuse from kitchen.
30–6–09.	1 *Chrotogonus* sp.
	5 *Camponotus compressus*.
	Ficus fruit and vegetable matter.
29–9–08.	2 Frogs.
	1 Centipede.
	2 Earthworms.
	A good deal of vegetable matter mostly grass but a good proportion of leaves.
12–10–08.	Maize only.
31–10–08.	1 Coprid sp.
	21 Moth eggs.

4. *Corvus macrorhynchus,* Jungle Crow.—*contd.*

A vast amount of other matter probably remains of caterpillars, which it was feeding on when shot.

Sept. and Oct. 07.
10 Specimens.
301 Maize seeds.
7 Frogs.
2 Lizards.
31 Weevils *Astycus* sp., *Myllocerus* sp.
A large proportion of young wheat and oat blades amongst the other vegetable matter.
A large proportion of the maize was obtained otherwise than in the field.

Summary.—Of 65 insects taken by 33 birds, none are beneficial, 40 injurious and 25 neutral. 14 birds took injurious and 6 neutral insects.

Worms were taken by 2, lizards by 2, frogs by 8, and centipedes by 3.

Vegetable food was far in excess of the animal. Oats were taken by 6, wheat by 1, maize by 11, Ficus fruit by 3 and ber (*Zizyphus jujuba*) by one, Bombax flower by 4; all contained vegetable matter.

Of the feeding habits of this crow Jerdon—B. I., II, 296—remarks: "It is gregarious; feeds on offal and carrion. It is often the first to discover the carcase of any dead animal. Like the rest of its tribe, however, it will partake of any kind of food, and Sundevall said that he found nothing but larvæ and butterflies in those he examined.

It is very destructive in some places to young chickens, pigeons, etc., and, I am informed, will occasionally destroy a young kid. It also pilfers the eggs and the nestlings of many birds; on which account the King Crow (*D. macrurus*) pursues it more relentlessly than it does the common crow."

Crows feeding on the carcase of a dead camel....2 or 3, if not all, of these, were Jungle Crows. But possibly there were some carrion crows among them. B. N. H. S. J., 19, 358.

Little can be said of the Jungle Crow that does not equally apply to the house crow. The Jungle Crow, however, is not quite

such a common bird, nor does he frequent large towns and villages so much. He is always found in and around villages and in thin jungle. Both *C. macrorhynchus*, and *C. splendens* may nearly always be seen in each other's company, and their food differs to a very slight extent.

The Jungle Crow is very fond of frogs and lizards, and is often seen worrying the latter to death and then not eating them. He feeds on carrion and offal, and kitchen refuse just as much as the House Crow, and also takes grain.

Maize in all parts of India—North and South—suffers considerably from the attack of this bird, especially in garden cultivation and early crops. In Madras, and on the West Coast especially, the Jungle Crow does some considerable damage to the paddy when ripening. I noticed this at Coimbatore, Shoranore, Salem, etc. He is a great pest to groundnut cultivation, and in many districts where this crop is grown, coolies with slings have to be employed as bird-scarers. No doubt *C. splendens* also attacks paddy and groundnut, but I did not notice this bird at the time. The Jungle Crow is also very partial to the flowers of the silk-cotton tree—*Bombax malabaricum*—to all kinds of *Ficus*, and to Mulberries.

The insect food is not particularly varied, consisting mostly of dung beetles and various scarabids:—*Onthophagus, Gymnopleurus*, etc., and weevils. Centipedes are occasionally taken, and these together with grass and weed seeds of various sorts form a very large percentage of its food. The stomachs I have examined have almost invariably contained vegetable matter much in excess of any other food material.

Flying Termites and swarming caterpillars are similarly taken by both the common species of Crows, and no doubt the Jungle Crow also destroys locusts, though we have no definite records of its doing so. Grasshoppers are taken to some extent and therefore we may assume that locusts are taken also.

Damage to crops is similar to that caused by the House Crow; linseed has, however, not been found in a single case.

The Harial is stated from the Punjab to keep loopers—*Tarache notabilis*—in check. This cannot refer to the Green Pigeon nor to the Common Indian Bee-eater both of which are locally known as Harrial, the former being purely frugivorous, the latter purely insectivorous and obtaining all its food on the wing and certainly not eating caterpillars. I believe this reference is to this Crow.

The Jungle Crow destroys and eats a large number of wild birds' eggs during the breeding season. A. S. B., LXIX, 104.

"The cultivators in certain parts" Faridpore, etc., "put bamboo poles here and there in the fields so that 'Saliks', Crows, etc., may sit on them and eat the grasshoppers." (*Hieroglyphus banian*) Rept. Ent. Collr., Dacca, 14-9-09.

5. *Corvus frugilegus.* Rook. Worms, snails, and grubs in meadows and ploughed land. F. I., I, 19.

6. *Corvus cornix.* Hooded Crow. In addition to eating the usual food of its ally, it is said to feed on grain. F. I., I, 20.

7. *Corvus splendens.* Indian House Crow.

2–2–07.		Grass roots, a few oat blades, much unidentified vegetable matter.
10–2–07.		Flower of *Bombax malabaricum.*
12–2–07.		Flower of *Bombax malabaricum.*
	2	Wheat grains.
	1	Small pebble.
1–3–08.	12	*Opatrum* sp.
	5	Oats.
	6	Vegetable matter.
14–3–08.	201	Oat grains.
18–3–08.	173	Oat grains.
18–3–08.	96	Oat grains.
21–3–08.	66	Oat grains.
	12	Wheat grains.
21–3–08.	94	Oat grains.
	3	Peas.
12–4–08.		Kitchen scraps including remains of fish, potato and some fat, portions of shell of hen's egg.
14–4–08.	1	Small Centipede.
	3	Wheat grains.
	2	Linseed grains.
		Some grass and bits of roots and leaves.
14–4–08.	8	Small worms.
	3	*Schizodactylus monstrosus.*
	2	*Brachytrypes achatinus.*
	1	*Gryllotalpa africana.*
	1	Legs of an ant (*Camponotus compressus*).

Corvus splendens :— (*contd.*)

	6	*Opatrum* sp.
	2	*Mesomorpha villiger.*
	1	*Gymnopleurus miliaris.*
		Some vegetable matter.
12–5–08.	1	Lizard.
		Some pieces of melon or pumpkin.
		Leaves and shoots.
21–5–08.		Potato peelings, 5 or 6 oats from stables and general kitchen refuse.
10–6–08.	1	Small frog.
	2	Centipedes.
		A few roots and leaves.
22–6–08.	33	Termites.
22–6–08.	42	Termites and some vegetable matter.
30–6–09.	2	*Ophiusa melicerte* larvæ.
	26	Maize grains.
		Ficus fruit.
30–6–09.	9	*Ophiusa melicerte* larvæ.
	41	Maize grains.
		Vegetable matter.
	2	Bits of bone.
30–6–09.	22	*Ophiusa melicerte* larvæ.
30–6–09.	1	*Ophiusa melicerte* larvæ.
	13	Maize grains.
		Ficus fruit.
30–6–09.		Ficus fruit.
30–6–09.	2	*Ophiusa melicerte* larvæ.
	9	Maize grains.
		Vegetable refuse, &c.
30–6–09.	1	*Catharsius sabœus.*
	23	Maize grains.
		Ficus Fruit.
2–7–08.		Mostly wild fig fruits (picked up from ground).
		Rice and scraps of pumpkin thrown away in the field by coolies.
23–7–08.	19	Maize grains.
26–7–08.	7	Maize grains.
4–8–08.	33	Maize grains.
10–8–08.	7	*Catharsius sabœus.*
3–10–08.	24	*Onthophagus spinifer.*
	2	*Onitis distinctus.*
	1	*Gymnopleurus miliaris.*
	75	*Panicum* sp. seeds.
9–10–08.	2	Frogs.
		Kitchen scraps and vegetable matter.
10–10–08.	1	*Oniticellus pallipes* (Coprid).
	2	Coprid sp.
	2	Coprid sp.
	10	Oat grains.
10–10–08.	12	Maize grains.
	6	Wheat grains.
	4	or 5 Ficus fruits.

Corvus splendens :—contd.

10–10–09.	5	*Camponotus compressus.*
	3	*Opatrum* sp.
	1	*Catharsius sabœus.*
	30	Maize grains.
		Some vegetable matter.
19–10–07.	25	Maize grains.
		Remains of perhaps 30 *Rhynchophora, Astycus* sp. and *Myllocerus* sp. ? ?
20–10–08.	21	Oat grains germinated (these had been pulled up in the field. Each grain well-rooted) and a considerable number of corn blades.
20–10–08.	12	Wheat grains.
20–10–08.		Gizzard empty. A few young oat blades in alimentary canal.
20–10–07.		Grass leaves (or oats, wheat, etc.) and roots.
		Some Ficus fruit.
	1	Small frog.
	3	Oat grains germinated.
11–11–07.	2	Millipedes.
	1	Frog.
	20	Panicum sp. seeds and other weed seeds.
9–12–08.		Remains of several young oat plants.
19–12–07.	6	Cutworms (*Agrotis* sp.).
	1	Elaterid grub.
	1	Carabid sp.
		Several bits of root and weeds.

Summary.—Of 226 insects taken by 42 birds, 1 is beneficial, 153 injurious and 72 neutral. Ten birds took injurious insects, 8 neutral and one beneficial. One contained insects only.

All except one bird contained vegetable matter; oats were taken by 13, wheat by 6, maize by 11, linseed by 1, peas by 1, Bombax flower by 2, and Ficus fruit by 6.

Four birds took frogs, 3 centipedes, 1 a lizard and 1 worms.

The Indian House Crow is one of the commonest and most familiar of Indian Birds, haunting especially the neighbourhood of towns and villages. Crows are omnivorous and certainly nothing seems to come amiss to the Indian House Crow. In towns these birds, with kites and dogs, act as useful scavengers, taking all manner of rubbish and offal, and may always be found round kitchens cleaning up scraps and stealing everything they can. They feed largely on carrion and any dead animal, jackal, dog, rat, etc., "on the corpse of some dead Hindoo or on that of a dead bullock" (Jerd. B. I., II, 299). They are proverbially mischievous and steal

anything they can, especially bright objects. They will also rob food of all descriptions from the kitchen, meat, bread, flour, etc., even taking dog's food, and often another crow's. "Crows steal food of animals in public garden, Trevandrum, no matter whether fish, flesh or fruit, all the same to this insatiable robber." (B. N. H. S. J., XV, 225).

Crows eat a great variety of fruits :—Banyan, pipal, and *Ficus* of all kinds. "They are always the first to attack a ripening mulberry or cherry tree." (Dewar, I. C., 17). They are very fond of wild mulberries and eat large quantities of this fruit both picking them from the tree or when fallen. They are particularly fond of the large red flowers of the silk cotton tree (*Bombax malabaricum*) and I have several times seen crows eating the fruit of *Cephalandra indica* (a wild cucurbitaceous plant). At Panimangalore in Madras I noticed crows attacking jack fruit. This is unusual. Crows do no harm to orchards.

Crows are said to be particularly fond of the young and eggs of other birds. 'Sparrows are the favourites' (Dewar, I. C., 16), more than other birds, but this I believe due to the fact that such birds are commoner than other birds in towns and localities frequented by crows and are therefore more readily obtained. 'They also take Bulbuls' (Dewar, I. C., 17). Crows rifle a nest of *Nucifraga hemispila* (B. N. H. S. J., XVII, 817) and no doubt do the same to any nest when they get the chance. I have seen a nest of *Crateropus canorus* robbed of its eggs.

A great variety of seeds is eaten by crows and at times they do a great deal of damage to crops. As soon as a crop such as wheat or oats begins to ripen, the crow breaks down a plant or pulls the head to the ground, if he cannot get at the seed, and then extracts the grain. In the case of maize, sorghum, etc., the crows perch on the plant and pick out the grain. If the crop is stooked before being carried, crows are then more obvious on the crop than at any other time : they sit on the stooks and feed entirely on the grain, just as the rook, *C. frugilegus*, does in England, etc. Crows damage maize

and oats more than other crops, but they will also eat wheat, barley, linseed, juar, and no doubt all cereal crops suffer to some extent, and perhaps pulses. The greatest amount of damage is done, however, soon after planting, when the crow will dig or pull up oats and wheat, as a rule just as the seeds are germinating; and again when young cereals are coming above ground, crows pull up and eat the young plants. They do not, as a general rule, pull up the plants to get at insects damaging those plants. If they did, they would scarcely be likely to eat the plants, on not finding insects. Insects are no doubt taken if found under these circumstances. A considerable amount of grain eaten by crows is picked up in farmyards, and from among cattle food round stables. Some also is undoubtedly taken from cattle dung, together with dung beetles (*Scarabæidæ*) of various kinds. A considerable number of wild grass and other weed seeds are taken, and also leaves and weeds including fumitory (*Fumaria parviflora*). Crows seem to delight at times in pulling up garden plants, sweet peas, etc., and, it is said, in picking flowers. "It is needless to say that they scrape up and eat newly sown seeds." (Dewar, B. P.). Crows rob chillies spread on the house roofs to dry. (B. N. H. S. J., XIII, 622). I have seen this on several occasions, but do not know whether the crow eats them, or simply takes them because of their bright colour.

With regard to their insect food, crows do not seem to have such a varied diet as one would expect. Being omnivorous, they can always obtain food in abundance anywhere, and therefore it is hardly to be wondered at that they do not feed much on insects as a general rule. If a flight of winged Termites takes place, as a rule, but by no means always, crows will be there catching the insects on the wing, together with numerous other birds, King-crows, Kites, Rollers, Bee-eaters, Doves, etc., and as Jerdon remarks "mayhap bats" (Jerd. B. I., II, 299). Swarms of locusts are nearly always accompanied by crows as well as the Rosy Pastor, and they destroy large numbers of these insects. And again, we have several records where crows have destroyed large numbers of swarming caterpillars (C. P. & E. B. & A.).

During an attack of the Castor Semi-looper (*Ophiusa melicerte*) on Castor, 1909, these crows fed to a certain extent on these caterpillars, but they were not present in large numbers and by no means attacked the caterpillars so much as one would have expected. Comparatively few birds were among the Castor and most were feeding as usual in the fields and trees, some examined at the time proving to have fed largely on Ficus, various insects, etc. The stomach contents of the birds shot on this occasion are among the records for 30-6-09.

Other than these instances we have few in which it can be said that crows are as beneficial as they could be. In fact, they are not generally beneficial at all. If they eat injurious insects, it is only at a time when these are in great numbers, a time when the damage caused by these insects has been done and when the destruction of thousands of these insects hardly makes any appreciable difference in their numbers. I consider an attack on insects by birds under these conditions as to all intents and purposes valueless : it can be of very small value in comparison with the good done by some bird which feeds habitually on injurious insects throughout the year and which, therefore, is always checking undue proportion of that insect's numbers. However, actual and not comparative economic importance is the point in question here. A crow only helps to lessen to a small extent the undue proportion of any one species of insect, when he notices they are in swarms and feels inclined to eat or worry them.

Crows have been said to feed on grubs (*Hypera variabilis*) on Senji. They will feed on silkworm moths (*Attacus ricini*) while alive, after being thrown away from the silk house. I once, at Pusa, took numbers of silkworm eggs from some crows, but these were almost certainly eaten together with the moths, the eggs not having been laid. Mr. Finn remarks "though most which are at all insectivorous with which I experimented, captive or wild, showed more or less desire for butterflies, some would not eat them at all—crows (*C. splendens*) for instance." (A. S. B., LXVI, 667). The presence of the larvæ of *Laspeyresia jaculatrix*, a Tortricid moth, was

observed on a sissoo tree (*Dalbergia sissoo*) on account of the crows there feeding upon them. (H. M. Lefroy, 1906-09). After land has been irrigated crows sometimes come in order to capture the insects that have been flooded out. These insects mainly consist of crickets (*Brachytrypes achatinus* and *Gryllotalpa africana*) and the Locustid [*Schizodactylus monstrosus*], and in addition cutworms and ants. Worms, too, are probably taken to some extent. Irrigated and flooded lands are also visited for crabs, frogs, and fish as well as for insects. "Crows may be seen on the coast squabbling with sea gulls over fish thrown away by the fisherfolk" (Dewar, I. C., 21), and also on the seashore they hunt for crabs, crustacea and small invertebrates. (Dewar, I. C., 22-23). They will, too, at times follow a plough picking up beetles, cutworms, Elaterid grubs, millipedes, and centipedes; but this is not a favourite method of obtaining food. More often than not the plough is not followed by any crows, and even if there are crows about, they sometimes are there simply waiting for scraps thrown away by coolies working in the field. Out of 21 visits to a field when being ploughed in order to obtain birds when so feeding, on seven occasions only were these birds seen on the land. This is, however, rather below the average. On pasture lands crows do little if any good. They are then usually feeding on grass, roots and leaves, etc., and picking out grain and beetles from cattle dung. From their actions when attending cattle, buffaloes, or animals of any sort in the field, we may almost certainly conclude that they are feeding on ticks and flies which are on these animals. I have so far, however, not obtained either of these from the stomachs of birds seen feeding under these conditions. (Jerd. B. I., II, 299) states definitely that they do so. "Crows will eat ticks that infest the skins of cattle." (Dewar, I. C., 18).

Crows may frequently be seen looking into pots on toddy palms, but whether they take the insects that collect round the pots, or the toddy itself, I do not know. They certainly do not seem to be so overcome by the toddy (if they take it) as *Loriculus* is said to be.

Crows are decidedly inquisitive birds. They take delight in worrying other birds and animals for no apparent reason whatever.

A very common habit which can often be noticed in India is the love they, with other birds, have of mobbing snakes. King-crows and mynahs usually join the crows in this, and should a snake cross a lawn or open space in the day time, one can usually tell what is the matter by the noise that these birds make in concert.

Crows may often be noticed worrying kites, though the kite takes very little notice of such attentions. An instance is recorded in the Bombay N. H. S. Journal how on a Green Pigeon shoot crows followed the pigeons and so showed on what trees the pigeons had settled.

Pitta brachyura (933) is often mobbed by crows. B. N. H. S. J., XVI, 491, and Jerd. (B. 3, 138) mentions the fact that a *Scops giu* found dead was probably killed by crows. I have seen crows pursuing and mobbing *Strix flammea*, which I once disturbed from a pipal tree at midday. The owl soon escaped. Crows will in fact mob any bird that happens to pass by, when they have nothing else to do.

Of crows Mr. W. L. Sclater (I. M. N., Vol. II, pp. 117-121) says :—"With regard to those of mixed diet....it would certainly be inadvisable to protect them, since they may do much greater harm in devouring fruit and grain than they do good in destroying insects; such is specially the case with crows and starlings."

From a glance at the stomach records one would feel that with regard to their insect food these crows are certainly beneficial, but it must be remembered that some considerable damage is done to grain, possibly considerably more than the injurious insects would have done. Crows cannot be definitely classed as beneficial, and require, if anything, to have their numbers kept within certain limits as is the case with *C. frugilegus* in England. Local conditions are the only ones that can determine this, and certainly nothing can possibly be said by way of recommendation either way, generally speaking for India, with a bird that has such varied food materials.

The Koel (*Eudynamis honorata*) deposits its eggs in the nests of this species, and though it apparently does not turn out the crows from the nest possibly keeps a small check on the crow's numbers.

I have, however, never seen young crows and young koels being fed together after leaving the nest, which would certainly have been the case had the two species of birds been reared up in the same family.

8. *C. insolens.*—Burmese House-crow. The usual pest. B. N. H. S. J., XVII, 184.

Pica.—Very omnivorous. (Jerd. B. I., II, 305).

Magpies rob and kill a bulbul. (B. N. H. S. J., XIII, 184).

Magpies eat eggs of *Amaurornis phœnicurus.*—(B. N. H. S. J., XIV, 776). Magpies suck eggs; Magpies (and Jays) feed largely on the ground and eat slugs, snails, worms, insects, nuts, acorns, grain, seeds of Conifers and other fruits.

Urocissa.—Chiefly on large insects. (F. I., I, 26).

12. *U. occipitalis.*—Red-billed Blue Magpie. It will eat raw meat, young or small birds, insects, and indeed almost any kind of food. (Jerd. B. I., II, 310).

13. *U. flavirostris.*—Yellow-billed Blue Magpie. Chiefly on large insects, grasshoppers, locusts, etc. (Jerd. B. I., II, 311).

14. *Cissa chinensis.*—Green Magpie. Grasshoppers, locusts, mantids, etc., off leaves and branches.... Also small birds. Highly carnivorous. (Jerd. B. I., II, 312).

Birds. (A. S. B., XXXIX, II, 109).

Dendrocittinæ.—Fruit and insects, and occasionally even capture young and sickly birds. (Jerd. B. I., II, 313).

16. *Dendrocitta rufa.*—Indian Tree Pie. At times it feeds almost exclusively on fruit, at other times on insects, grasshoppers, locusts, mantides, and caterpillars. Mr. Smith says, he had known this bird enter a verandah of a house, nip off half a dozen young geraniums, visit a cage of small birds, begin by stealing the grain, and end by killing and eating the birds. Mr. Buckland informs me that he has known it enter a verandah and catch bats. (Jerd. B. I., II, 314).

Spends most of its time in picking insects off the leaves and branches of trees. When fruit is in season, it feeds largely on that and frequently descends to the ground to feed and drink. (Dewar, B. P., 71). '*Dendrocitta rufa* is very plentiful here' (Cawnpore); as are also fruit trees, and I have never seen one feed on anything but fruit.' (B. N. H. S. J., XVI, 503).

Stomachs examined :—

12–1–08.	Entirely on Ficus fruit.
13–2–08.	2 Small caterpillars.
	Much Ficus fruit remains.
26–2–09	2 *Myllocerus? discolor.*
	Ficus fruit.
8–3–09.	7 *Myllocerus discolor* (heads, elytra).
	3 *Noctuid? moths heads.*
	Other remains probably parts of the 3 moths or of others.
12–3–09.	2 *Mutilla 6 maculata.*
	3 *Opatrum depressum?*
	Ficus fruit.
26–3–08.	20 Small broken Geometrid caterpillars.
	Much vegetable matter: Ficus fruit.
20–4–09.	1 *Sphex lobatus.*
	2 *Cremastogaster subnuda.*
	Ficus fruit.
	Remains of a small bird (*Phylloscopus?*)
19–6–08.	3 *Polistes hebræus.*
	1 *Rhynchium* (2 wings).
	Parts of an Hemipteron.
	1 *Spider* (leg only).
	3 Fleshy fruits with hard stones.
19–7–08.	1 *Myllocerus* sp.
	2 Small Geometrid caterpillars.
	6 Ficus fruits.
23–7–08.	1 *Polistes hebræus.*
	1 *Vespa orientalis.*
	1 Hemipteron. Scutellum.
	Leg and broken thorax of large Carabid.
	About eight banian fruits.
21–8–08.	2 *Polistes hebræus.*
	3 *Myllocerus maculosus.*
	1 Spider (legs).
	Ficus fruit.
9–10–08.	3 *Polistes hebræus.*
	2 *Myllocerus discolor.*
	2 (Remains of) other weevils.
	Other remains unidentifiable.
12–10–08.	1 *Myllocerus maculosus.*
	16 Flat leguminous seeds.
	2 Other seeds.
	61 Small brown seeds, No. 5.

Summary.—Of 68 insects from 13 birds, 13 are beneficial, 48 injurious and 7 neutral; 9 took injurious insects, 5 beneficial and 4 neutral.

Two birds took spiders and one a small bird. Of 11 birds that took vegetable matter, 9 took Ficus fruit.

The Indian Tree-pie is a very common bird, usually occurring in pairs or small parties of 6 or 7 birds. It is found everywhere where there is plenty of shelter, and is especially fond of Ficus trees. Most of the food is obtained on the ground, and on trees and bushes, and a very small proportion on the wing and that only when flying Termites emerge.

This bird is to a very large extent a vegetable feeder, though it does not apparently damage crops or planted seeds. It takes a variety of weed seeds and fruits of all kinds including all the common species of Ficus, Ber fruit (*Zizyphus jujuba*), Mulberries, Sissoo seeds, etc. Of cultivated fruits when they are in season, it takes peaches, loquats, plantains, etc., and besides eating the fruit on the trees it will often knock off a considerable amount more. Not only does it thus damage the fruit, but it also breaks off small branches (which often contain fruit buds) of brittle wooded varieties of trees when it alights on them, and is therefore not to be desired in a carefully kept orchard. Leaves and buds of various sorts are also eaten, but apparently only of wild plants.

The Tree-pie's insect food is very varied, but undoubtedly some preference is shown to caterpillars, principally Geometrids and some other smooth varieties—I have never known it touch a hairy one—to beetles which are mostly Tenebrionids and to a less extent to the common wasp [*Polistes hebræus*]. I once had two Sphingid larvæ (*Theretra oldenlandiæ*) in a tin on my window ledge, and while reading I heard a slight noise and saw one of these birds fly off with the second of these larvæ, the first having been taken without my noticing it. It does not as a general rule take crickets; I have continually watched Tree-pies feeding in the same place as Brahminy Kites, the latter feeding entirely on the crickets (*Brachytrypes achatinus*) and have only once seen

the Tree-pie take one of the crickets. At Pusa this bird was somewhat of a nuisance round the silk-worm rearing house, as it stole a good many of the caterpillars (*Attacus ricini*) being reared there in 1907.

A favourite hunting ground with this bird is bungalow verandahs. It is by no means a shy bird, perhaps being one of the boldest birds that we have, and will even enter a room in search of food. In Southern India, however, it is said to be not quite so bold. "It frequents gardens, but I have never known it enter a verandah." B. N. H. S. J., XV, 256. I once saw a Tree-pie take a lizard from a window in the following manner. He saw the lizard from outside, and when after one or two attempts he found he could not get at it through the glass, he flew down, entered the room through the door, and after capturing the lizard took it outside and ate it. That Tree-pie had been in the bungalow before, and so apparently knew his way about well. Lizards are very often taken from the outsides of window panes and in verandahs, but I have never noticed any lizards other than the common Indian house lizard (*Hemidactylus gleadovii*) to be taken.

Tree-pies are particularly fond of lizards, and it is for this reason more than anything else that they enter verandahs so boldly.

"Particularly fond of lizards." B. N. H. S. J., XIII, 622. I have seen the following insects taken in verandahs :—

Polistes hebræus.	*Spodoptera mauritia.*
Ophideres fullonica.	*Prodenia littoralis.*
Ophideres materna.	*Ancylolomia chrysographella.*
Plecoptera reflexa.	*Plusia* sp.
Caradrina exigua.	*Opatrum* spp.

Sand flies—*Phlebotomus* sp. ?—are also said to be taken, but I have not observed this. Spiders are also taken in verandahs as elsewhere. It will be seen that many of the insects taken in verandahs belong to injurious groups, but all the good done by the destruction of these injurious insects is more than counterbalanced by the harm done in destruction of spiders and lizards.

This diet is supplemented by insects of various other kinds, and occasionally by snails, centipedes, small frogs and birds.

During the nesting season the Tree-pie is said to rob other birds' nests, being very fond of nestlings and eggs. B. N. H. S. J., XIV, 164. *Orthotomus sutorius*, B. N. H. S. J., XIII, 622. Young *Thamnobia cambaiensis*, B. N. H. S. J., XVI, 503, and is also said to persecute *Zosterops palpebrosa* at the breeding season, B. N. H. S. J., XIII, 623. It takes doves' eggs. Dewar B. P., 69. I have seen it eating a young *Arachnechthra asiatica*, but do not know if the Tree-pie had killed it.

The young are fed almost entirely on caterpillars, fruit perhaps forming some proportion of their diet.

My records of 12 stomachs of this species examined in 1907, together with a number of stomachs (bottled) have been mislaid. I noted in a report at the end of that year as follows : "It is to a large extent a vegetable feeder, taking amongst other fruits those of the ber (*Zizyphus jujuba*), pipal and various other species of Ficus and apparently a large proportion of its diet consists of weed seeds. It sometimes feeds on the ground, but never feeds on young plants or crops, or on planted seeds : leaves of various kinds are eaten though to a minor extent. Insects and spiders are eaten though to a less extent than vegetable matter, several stomachs examined containing neither. As a rule, several insects occur, these being small crickets, ants of various large species (*Camponotus*, *Myrmecocystus*, etc.) and beetles, mostly Tenebrionids. Caterpillars form a large portion of the insect-food, these being mostly Geometrids, none are hairy, and the scutella of various small Hemiptera are almost always present. I noted two birds to have taken spiders, one spider in each bird ; a *Chrysis* sp. occurred once. This bird occasionally takes small snails. It frequently hawks in Bungalow verandahs, taking lizards and moths and occasionally beetles."

17. *D. leucogastra.*—Southern Tree-pie. Fruit only. Jerd. B. I., II, 318.

18. *D. himalayensis.*—Himalayan Tree-pie. Feeds on trees on insects and fruit. I have, however, seen it on the ground eating grain. Jerd. B. I., II, 316.

19. *D. frontalis.*—Black-browed Tree-pie. Fruit and insects of various kinds. Jerd. B. I., II, 317.

Crypsirhina.—Search leaves for insects. They also feed on fruit. F. I., I, 34.

Platysmurus.—Insects and occasionally fruit, probably among trees. F. I., I, 36.

GARRULINÆ.

Feed on various kinds of insects and fruit, occasionally robbing other birds' nests of their young and eggs. Jerd. B. I., II, 306.

All kinds of animal and vegetable food. F. I., I, 37.

Garrulus.—More frugivorous than most of the *Corvidæ*, but they will eat also insects, worms, eggs and even small birds. Jerd. B. I., II, 307.

Nucifraga.—Chiefly on seeds and nuts, but also on insects and small birds. Jerd. B. I., II, 303. Seeds of Pine and cedar; they also eat seeds and fruits and also insects. F. I., I, 40.

27. *Nucifraga hemispila.*—Himalayan Nutcracker. (14 nuts, a kind of bastard hazel). B. N. H. S. J., XVII, 229. Seeds of *Pinus excelsa*, walnuts when in season, grubs, larvæ of beetles, and other boring insects. B. N. H. S. J., XIV, 819.

Graculus. Much the same substances as the rook. F. I., I, 42.

30. *Pyrrhocorax alpinus.*—Yellow-billed Chough. Various fruits, especially the mulberry. Jerd. B. I., II, 319.

PARINÆ.

Tits.

Strictly arboreal, omnivorous, feed equally on seeds, fruits and insects and they pierce hard seeds and nuts with their strong conical bill, holding it with their feet and thus extract the kernel. Jerd. B. I., II, 271.

Tits live chiefly on insects, but they also eat seeds and in the hard weather no sort of food comes amiss to them. F. I., I, 45.

The food consists mainly of insects, their eggs, larvæ and pupæ, but at times of Conifer seeds, acorns, beech-mast, nuts and the like; while in winter a suspended meat bone, fat, or crumbs prove great attractions. No doubt a certain amount of fruit is eaten in summer and buds are plucked in spring, but the latter commonly contain injurious grubs. E. B. C. N. S., 540. The commoner species are very partial to coconut at all times of the year if given to them.

31. *Parus atriceps.*—Indian Grey Tit.

Various insects and seeds. Jerd. B. I., II, 278.

Stomachs examined :—

2–2–09.	15	Weevils (much broken).
2–2–09.	2	*Myllocerus discolor.*
	18	Small *Coleoptera.*
	1	Bud and some vegetable matter.
10–2–08.	3	*Myllocerus* sp.
	2	*Drasterius* sp.
	5	Small Elaterids.
15–2–07.	4	Small weevils.
	5	Tineid caterpillars.
	1	Hemipteron (scutellum).
	13	Pentatomid eggs : (*Coptosoma* sp. ?).
8–3–09.	1	Weevil.
		Some broken buds.
20–5–08.	1	*Tanymecus* sp.
	3	Small weevils.
	3	Small caterpillars.
10–6–08.	5	Small weevils.
	1	Flea-beetle (*Halticinæ*).
	3	Buds and some other vegetable matter.
	1	Piece of bark.
19–7–08.	5	Small weevils (*Cryptorhynchinæ*).
	1	*Camponotus compressus.*
	1	*Polyrachis simplex.*
	103	Pentatomid eggs.
20–7–08.	1	*Œcophylla smaragdina.*
	12	*Tanymecus* sp. and other weevils
	1	Small Elaterid.
	1	Bud.
31–10–08.	2	*Balaninus* sp.
	8	*Myllocerus* sp. and other weevils.
	2	Small caterpillars.
	1	Hemipteron (scutellum).

Summary.—Of 219 insects taken by 10 birds, 0 are beneficial, 148 are neutral and 71 injurious. Seven took neutral and 10 injurious insects. Three birds took vegetable matter.

Field Notes.—The common Tit of the plains; breeds in holes in trees, but those in walls, etc., seem to be preferred. The young are fed chiefly on small caterpillars (probably Geometrids) on spiders, and on young crickets, such as *Brachytrypes achatinus* and on mole crickets (*Gryllotalpa africana*).

In most of the stomachs containing vegetable matter this form of food was probably derived from the contents of the caterpillars, which usually occur in the bird.

34. *Parus monticola.*—Green-backed Tit. Insects and larvæ. Jerd. B. I., II, 277.

35. *Ægithaliscus erythrocephalus.*—Red-headed Tit. Chiefly insects. Jerd. B. I., II, 271.

40. *Sylviparus modestus.*—Yellow-browed Tit. Chiefly on minute insects. Jerd. B. I., II, 267.

43. *Machlolophus haplonotus.*—Southern Yellow Tit. Fruit and insects, like other *Ampelidæ*. Bombay Gazette, Ahmedabad. IV, 81.

PARADOXORNITHINÆ.

Their food is not grain and seed, but insects. F. I., I, 60.

50. *Conostoma œmodium.*—Red-billed Crow-Tit. Chiefly insects in summer, in winter doubtless some vegetable food. Jerd. B. I., II, 11.

51. *Paradoxornis flavirostris.*—Yellow-billed Crow-Tit. Various seeds. Jerd. B. I., II, 4.

It does not appear to be the usual habit of these birds to eat seeds. F. I., I, 62.

Wild berries: entirely a fruit eater. B. N. H. S. J., VIII, 166.

Suthora.—Feeding on insects. F. I., I, 63.

53. *S. unicolor.*—Brown Crow-Tit. Bugs and other insects. Jerd. B. I., II, 7.

55. *S. nepalensis.*—Ash-eared Crow-Tit. Habits of a Parus. Jerd. B. I., II, 9.

58. *S. rufipes.*—Smaller Red-headed Crow-Tit. Bamboo seeds. Tickell found it feeding on grain, maize, rice and buck-wheat. Jerd. B. I., II, 6.

59. *S. atrisuperciliaris.*—Black-browed Crow-Tit. Grass-hoppers and small beetles. B. N. H. S. J., VIII, 169.

60. *Scœorhynchus ruficeps.*—Larger Red-headed Crow-Tit. Mostly insectivorous : rice, grain and berries. B. N. H. S. J., VIII, 170.

61. *S. gularis* (= ? *Megalaima caniceps*).—"Those I have killed had the bristles about their bills covered with gummy matter, evidently from some fruit." A. S. B., XL (II), 209.

Speaking of the food habits of the *Corvidæ* as a class is a very different matter in comparison with those of all other families of the Passerine group. In nearly all other Passerine groups we find that there is a general similarity of feeding habits amongst the various species and genera of one family, but in the case of the Corvidæ generic, and in some cases specific distinction, is essential.

Corvinæ.—The genus *Corvus* contains—

1. Ravens. Mostly carnivorous but with the general habits of the crows. Such individuals as attack lambs—Ravens are said to do this at times—can easily be destroyed. They occur in North-West India.
2. The Carrion-crow is comparatively rare, but is in other countries generally considered as injurious owing to the fact that it destroys a considerable number of the eggs of other birds, notably of game. The Rook, Crows and the Jackdaw are in all probability beneficial provided that they are kept within certain number limits. They are more omnivorous than other members of the genus, the Crows, which are the only species of importance in the plains, practically eating every thing; in fact they are the most truly omnivorous birds there are.

The Magpies are almost, though not quite, as omnivorous as Crows. They are all hill species and of little importance.

The only Tree-pie (*Dendrocitta*) of importance is *D. rufa*. The habits have already been discussed, and it is apparently beneficial, though it may at times do some damage in orchards, and we must regard other species in the same light, though they are uncommon and entirely confined to the hills. They are mostly insectivorous and frugivorous.

The Nutcrackers (*Nucifraga*) are entirely hill birds, and when common may damage nuts, though much damage attributed to these birds is probably done by squirrels. They are said to eat boring beetle grubs, and if so this more than counterbalances any damage they may possibly do to nuts, which are mostly wild species, hard-shelled and of little real value.

Parinæ.—Tits, though fairly numerous in species, are noticeably absent from the plains where we have only one common species, *P. atriceps*. All the other species are practically confined to the hills. Tits in India as elsewhere are probably beneficial.

Paradoxornithinæ.—Crow-Tits have the habits of Tits and are confined to the hills.

CRATEROPODIDÆ.

The *Crateropodidæ* are subdivided into the following sub-families: *Crateropodinæ*, *Timeliinæ*, *Brachypteryginæ*, *Sibiinæ*, *Liotrichinæ* and *Brachypodinæ*.

Of the *Timeliinæ*, Evans says "Many species scratch up the soil or dead leaves in search of insects and other larvæ which, with seeds, constitute the chief food: fruit however or even small reptiles, crabs, worms, molluscs, are occasionally eaten." E. B. C. N. H., 503. He includes however several genera placed elsewhere in the Fauna of India, such as *Suthora*, etc.

The *Crateropodinæ* comprise Laughing Thrushes, Babblers and Scimitar Babblers.

"All feed on the ground like Thrushes. They pass a good deal of their time on trees, but they probably derive no portion of their food directly from trees, the fruit they occasionally eat being picked off the ground as they forage for insects." F. I., I, 72.

Dryonastes.—They eat almost every sort of insect and the smaller reptiles, and they no doubt partake of fruit also.

62. *D. ruficollis.*—Insects and seeds....Hamilton "Insects, Plantains, &c." Jerd. B. I., II, 38.

Garrulacinæ.—Laughing Thrushes. Chiefly on the ground. Eat insects, berries, and caterpillars....Grain, larvæ of insects in the dung of cattle...On the whole they are more insectivorous than frugivorous or graminivorous, yet they are more capable of a graminivorous diet than the true thrushes. Often kept in Nepal in walled gardens, when they are very useful, destroying larvæ and insects. Jerd. B. I., II, 34.

64. *Garrulax chinensis.* Black-throated Laughing-Thrush. In captivity on raw meat, bees, wasps and large beetles, and small snakes. Jerd. B. I., II, 34.

69. *Garrulax leucolophus.*—Himalayan White-crested Laughing-Thrush. Turn over dead leaves for insects, but also eat various berries. Jerd. B. I., II, 35.

78. *Ianthocincla ocellata.*—White-spotted Laughing-Thrush. Various fruits and seeds. Jerd. B. I., II, 42.

79. *I. cineracea.*—Ashy Laughing-Thrush. Fruits and Insects. F. I., I, 86.

82. *Trochalopterum erythrocephalum.*—Red-headed Laughing-Thrush. Snails. A. S. B., LXIX, 158.

85. *T. nigrimentum.*—Western Yellow-winged Laughing-Thrush. Insects and Grain among dung of cattle. F. I., I, 92.

86. *T. melanostigma.*—Chestnut-headed Laughing-Thrush. Exclusively on insects. F. I., I, 93.

93. *T. cachinnans.*—Nilgiri Laughing-Thrush. Chief food appears to be fruit, especially that of the peruviana, but they occasionally eat caterpillars and other insects. Jerd. B. I., II, 49.

101. *Grammatoptila striata.*—Striated Laughing-Thrush. Fruit and seeds only. A. S. B., XLV, 73.

Fruit and insects, chiefly the latter. Jerd. B. I., II, 212.

102. *G. austeni.*—Austen's Striated Laughing-Thrush. Entirely of fruits and seeds. F. I., I, 104.

104. *Argya earlii.*—Striated Babbler. More exclusively on insects than *Ch. caudata*. Jerd. B. I., II, 69.

105. *A. caudata.*—Common Babbler. In confinement on grain. Jerd. B. I., II, 68.

107. *A. malcolmi.*—Large Grey Babbler. They feed chiefly on the ground especially round the trunks of large trees, near hedgerows, turning over the fallen leaves with their bills and sometimes with their claws and picking up various insects, beetles, cockroaches, grasshoppers, etc., and also seeds and grain. I once saw one in vain attempt to catch a grasshopper on the wing. Jerd. B. I., II, 64.

110. *Crateropus canorus.*—Jungle Babbler.

Stomachs examined :—

9-1-08.	23 *Mesomorpha villiger.*
	3 *Opatrum depressum.*
	Vegetable matter including grass, grass-seeds and broken ber fruit which was undoubtedly taken from ground.
19-1-08.	2 *Camponotus compressus.*
	Vegetable matter : leaves and grass with a few seeds.
2-2-07.	2 *Œcophylla smaragdina.*
	10 *Myllocerus discolor.*
	3 *Mesomorpha villiger.*
	14 *Opatrum* sp.
	Weed seeds and leaves, including 1 shoot of bamboo, and a little Ficus.
2-2-07.	Entirely vegetable, weed seeds and leaves, partly grass.
2-2-08.	1 Blattid.
	6 *Camponotus compressus.*
	3 *Opatrum depressum.*
14-2-08.	2 *Camponotus compressus.*
	23 *Mesomorpha villiger.*
	1 *Trox indicus.*
	1 *Myllocerus discolor.*
	2 „ *blandus.*
	1 Small caterpillar.

Stomachs examined :—contd.

	1	Fly.
		Some vegetable matter.
15–2–09.	16	*Opatrum* sp.
	2	*Myllocerus discolor.*
	1	*Mesomorpha villiger.*
	23	*Cydnus nigritus.*
	9	„ *varians.*
18–2–07.	9	*Opatrum depressum.*
18–2–07.	1	*Camponotus compressus.*
	27	*Mesomorpha villiger.*
	1	*Scleron orientale.*
	3	*Opatrum* sp.
		Grass seeds and leaves.
26–2–09.	1	Blattid sp.
	1	*Myllocerus discolor.*
	17	*Mesomorpha villiger.*
12–3–09.	5	*Myllocerus discolor.*
	4	Pieces of doub grass. (*Cynodon dactylon*).
		Ficus and other remains.
14–3–07.	1	*Camponotus compressus.*
	11	*Mesomorpha villiger.*
	5	*Myllocerus discolor.*
	1	Cutworm, *Agrotis* sp. Larva.
28–3–08.		Entirely vegetable : ficus : grass leaves and some weed seeds.
1–4–08.	1	*Onthophagus* sp.
	1	*Hister* sp.
	1	*Trox indicus.*
	2	Small Elaterid.
	7	*Cydnus nigritus.*
3–4–08.	2	*Myllocerus* sp.
	20	*Myllocerus discolor.*
	5	Paddy grains and other vegetable matter.
12–4–08.		Entirely weed seeds and leaves : almost empty.
14–4–07.	1	Elaterid grub.
	3	Cutworms sp.
		Some ficus fruit and other weeds and seeds and insect remains.
14–4–07.	10	*Œcophylla smaragdina.*
	5	*Mesomorpha villiger.*
		Some ficus and other remai.
16–4–08.	5	*Mesomorpha villiger.*
	20	Tenebrionids. *Opatrum* sp.
	3	*Myllocerus discolor ?*
	3	Caterpillars, *Agrotis* sp.
13–5–07.	2	*Œcophylla smaragdina.*
	1	*Opatrum* sp.
	4	Cutworms, *Agrotis* sp. Larvæ.
		Ficus fruit.
18–5–08.	1	*Chrotogonus* sp.
	2	*Brachytrypes achatinus.*
	24	*Camponotus compressus.*
	4	*Opatrum* sp.
	1	*Scleron orientale.*

Stomachs examined :—contd.

	5 *Myllocerus blandus.*
21–6–07.	2 *Gryllotalpa africana.*
	6 *Hydrophilides.*
	1 *Aphodius* sp.
	Ficus fruit.
21–6–07.	Entirely vegetable, doub grass and seeds and other weeds and leaves.
22–6–08.	1 *Gryllotalpa africana.*
	1 *Astycus* sp.
	1 *Myllocerus discolor.*
	3 „ *maculosus*
	1 Small Coprid.
	Various elytra and vegetable matter.
16–7–08.	Absolutely empty: probably vegetable only
20–7–08.	Vegetable including Ficus.
	1 Paddy grain.
12–8–08.	10 *Camponotus compressus.*
	3 *Onthophagus spinifer.*
	6 *Cydnus nigritus.*
	1 „ *varians.*
	3 *Opatrum* sp.
	4 Worms.
19–8–08.	3 Small frogs.
	Ficus fruit.
2–9–08.	1 *Camponotus compressus.*
	1 Small frog.
	Vegetable grass weed leaves, &c., few seeds of ficus.
12–10–07.	4 *Myllocerus* sp.
	2 *Astycus* sp.
	3 Small frogs.
	Some vegetable matter.
12–10–07.	1 *Myllocerus discolor.*
	2 Small frogs.
	Leaves and weed seeds.
12–10–08.	1 *Haltica cyanea.*
	1 Coprid.
	1 *Anomala viridis.*
14–11–08.	3 *Myrmecocystus setipes.*
	1 *Phidole* (*malinsi* sp.
	1 *Opatrum depressum.*
	3 *Myllocerus* sp.
	1 (Coprid ? Legs only).
	1 Hemipteron (head).
12–12–07.	12 *Opatrum depressum ?*
12–12–07.	21 *Opatrum depressum ?*
17–12–07.	8 Small *Coleoptera.*
	Ber buds, Ficus, weed leaves and seeds.

Summary.—Of 456 insects taken by 36 birds, 0 are beneficial, 185 injurious, and 271 neutral. Twenty-four birds took injurious insects and 22 neutral. Twelve took insects only, 4 took frogs and 1 worms.

Vegetable matter forms a considerable portion of the diet, and this consists very largely of wild fruits. 23 birds took vegetable matter, and of these 10 took Ficus fruit, 2 "ber," and 2 took paddy grains.

The "Seven Sisters," so called from their habit of going about in parties of six or seven; I, however, have seen as many as 23 in a flock. Their food is, I believe, obtained entirely on the ground, and consists of a great variety of insects and weed seeds, with an occasional frog, spider, or centipede. The food is obtained in jungle, along roads and in compounds; cultivated areas and crops hardly ever seem to be visited, and this only when there are large trees or jungle close by. The insect food is obtained by turning over leaves and rubbish. Fruits, namely, ber (*Zizyphus jujuba*) and Ficus of several species are eaten to some extent, but I believe are always picked up off the ground. I have been told that at times this bird feeds extensively on fruit buds, and does some considerable damage, but have at present not been able to verify this. I have not examined any nestlings of this species, but from observations made in the field they appear to be fed principally on caterpillars. I have on several occasions seen geometrid larvæ fed to the young—with a certain proportion of beetles, and an occasional cricket or small grasshopper.

Conclusion: Probably beneficial.

111. *Crateropus griseus*.—White-headed Babbler. They are occasionally seen seeking insects or grain from heaps of dung. . . . now and then one will make a clumsy flight after a grasshopper. They often appear to pick insects off the branches. Jerd. B. I., II, 60.

I saw worms ? and Tenebrionid beetles, and one grasshopper taken by this bird in Madras and Palur.

120. *Pomatorhinus horsfieldii*.—Southern Scimitar Babbler. Entirely on insects. Jerd. B. I., II, 31.

Insects which it picks off leaves, ground or trunks of trees. It uses its long bill as a probe by means of which it drags out insects which lurk in crevices of the bark of trees. B. N. H. S. J., XVI, 153.

16, etc.—*Pomatorhinus* exclusively insectivorous. Jerd. B. I., II, 28.

TIMELIINÆ.

Babblers, Shrikes, Tits, and Spotted-Babblers.

They are mostly social, or even gregarious: they are a good deal on the ground, on which they hop vigorously, or climb with facility through tangled thickets and reeds, and their food is both insects, fruits and grain. Jerd. B. I., II, 1.

Solitary in their habits or rather are less gregarious than the Crateropodinæ. Some of them are said to go about in flocks, but this by no means a general or usual character with them: they are above all things skulkers frequenting the ground or underwood, and being seldom found many feet above ground. F. I., I, 129.

Timeliinæ.—Babbling-Thrushes. Chiefly on ground. Their food is both insects, fruits and grain. Jerd. B. I., II, 1.

136. *Dumetia albigularis.*—Small White-throated Babbler. Insects almost exclusively. Jerd. B. I., II, 27.

137. *Gampsorhynchus rufulus.*—White-headed Shrike-Babbler. Grasshoppers and other insects. Jerd. B. I., II, 14.

139. *Pyctorhis sinensis.*—Yellow-eyed Babbler. Mostly on insects, often on ants and small Coleoptera. Jerd. B. I., II, 16.

144. *Pellorneum ruficeps.*—Spotted-Babbler. Fond of thick jungle in which it wanders about like a lark, and turns over leaves in search of moths several of which I saw captured. B. N. H. S. J., XV, 347. Various insects. Jerd. B. I., II, 27.

155. *Gypsophila crispifrons.*—Limerock Babbler. Feeds principally on insects and land shells. F. I., I, 150.

163. *Alcippe nepalensis.*—Nepal Babbler. Chiefly insects. Jerd. B. I., II, 18.

164. *A. phœocephala.*—Nilgiri Babbler. Chiefly insects. Jerd. B. I., II, 19.

166. *Rhopocichla atriceps.*—Black-headed Babbler. Lives on various insects, small Mantidæ, grasshoppers and the like. Jerd. B. I., II, 19.

169. *Stachyris nigriceps.*—Black-throated Babbler. Chiefly insects. Jerd. B. I., II, 21.

170. *S. chrysæa.*—Golden-headed Babbler. Minute insects on flowers and buds. Head often covered with pollen. Jerd. B. I., II, 23.

172. *Stachyrhidopsis ruficeps.*—Red-headed Babbler. Minute insects. Jerd. B. I., II, 22.

176. *Mixornis rubricapillus.*—Yellow-breasted Babbler. Insectivorous. B. N. H. S. J., X, 458.

178. *Schœniparus dubius.*—Hume's Tit-Babbler. Entirely insectivorous. F. I., I, 169.

182. *Sittiparus castaneiceps.*—Chestnut-headed Tit-Babbler. In addition to Tit-like habits they frequently climb upon the vertical trunks of trees, clinging to the bark or moss, and searching every cranny or crevice for insects.

185. *Rimator malacoptilus.*—Long-billed Babbler. Remains of insects in its stomach. Jerd. B. I., I, 493.

BRACHYPTERIYGNÆ.

Whistling-Thrushes, Blue Chats and Shortwings. Habits terrestrial.

187. *Myiophoneus temmincki.*—Himalayan Whistling-Thrush. Larvæ of *Libellulæ* and some other water insects. Jerd. B. I., I, 500. Largely on snails, the shells of which are frequently found accumulated on the ground where the bird has the habit of breaking them. F. I., I, 179.

189. *M. horsfieldi.*—Malabar Whistling-Thrush. Various insects, earthworms, slugs, shells and also crabs, which I have frequently found constituting its sole food and the remains of legs, etc., of these crustacea are generally found on the rocks at the edge of

every pool of water frequented by it. Earthworms and snails in captivity. Jerd. B. I., I, 499.

Larvivora: mostly ground birds; on insects. Jerd. B. I., II, 145.

190. *Larvivora cyanea.*—Siberian Blue Chat. Insects' nests and larvæ. Jerd. B. I., II, 146.

191. *L. brunnea.*—Indian Blue Chat. Insects' nests and larvæ. Jerd. B. I., II, 146.

197. *Drymochares cruralis.*—White-browed Shortwing. Larvæ of insects and worms. Jerd. B. I., I, 495.

198. *D. nepalensis.*—Nepal Shortwing. Chiefly insects. Jerd. B. I., I, 494.

Tesia.—Insects and seeds.

202. *Oligura castaneicoronata.*—Chestnut-headed Shortwing. I found insects alone in its stomach. Jerd. B. I., I, 487.

SIBIINÆ.

Sibias, Barwings, Staphidias, Sibias, Yuhinas, White-Eyes, Ixulus and Herpornis.

203. *Sibia picaoides.*—Long-tailed Sibia. Fruit and insects. Jerd. B. I., II, 56. F. I., I, 195.

204. *Lioptila capistrata.*—Black-headed Sibia. Fruit of the epiphytic Andromedæ...it occasionally however picks insects from moss or crevices of bark. Jerd. B. I., II, 55. Fruit and insects. F. I., I, 197.

205. *L. gracilis.*—Busy after insects on the large flowering forest trees, Simul esp. A. S. B., XXXIX, II, 105.

208. *L. annectens.*—Blyth's Sibia. Almost equally of insect, their nests, larvæ and pupæ, and of seeds. Berries are frequently eaten. Jerd. B. I., II, 249.

210. *L. pulchella.*—Beautiful Sibia. Flowers of Rhododendrons, for insects. Jerd. B. I., II, 201.

Do., heads and throats being covered with pollen. A. S. B., XLIII, II, 164.

211. *Actinodura egertoni.*—Rufous Barwing. Fruit and especially on insects. Jerd. B. I., II, 53.

213. *Ixops nepalensis.*—Hoary Barwing. Insects chiefly on Rhododendrons. Jerd. B. I., II, 53. F. I., I, 204.

214. *I. daflaensis.*—Austen's Barwing. Often entirely on green aphis. Larval form of the common locust and small hard seeds. B. N. H. S. J., VIII, 202.

Siva hunt large trees searching the leaves for insects. Jerd. B. I., II, 253, etc. F. I., I, 207.

Yuhina feed on viscid stony berries and fruit and tiny insects that harbour in the cups of large deep flowers, such as Rhododendrons. Jerd. B. I., II, 260. Feed largely on berries in addition to insects. F. I., I, 211.

223. *Y. gularis.*—Stripe-throated Yuhina. Small insects and larvæ. In winter they feed a good deal on small berries of various kinds. Minute insects in Rhododendrons. Jerd. B. I., I, 261.

224. *Y. occipitalis.*—Slaty-headed Yuhina. Berries. Jerd. B. I., II, 262.

225. *Y. nigrimentum.*—Black-chinned Yuhina. Seeds and small insects. Jerd. B. I., II, 262.

Zosterops: insects on leaves. F. I., I, 212.

226. *Zosterops palpebrosa.*—Indian White-eye. Minute insects that infest flowers. Blackberries of Rhamnus sp. Jerd. B. I., II, 266. Insectivorous. B. N. H. S. J., X, 459.

White-eyes and Flower-peckers do great damage to ripe mangoes and guavas. B. N. H. S. J., XI, 623. Plantains in captivity. B. N. H. S. J., XIII, 623.

Stomachs examined :—

3–3–07. 12–3–08. 25–3–08. 18–4–07. 17–4–09. 23–5–08. 31–5–07. 5–10–08. 21–10–07. 11–12–07.	These birds all contained small buds and seeds only. Three of them contained a little Ficus fruit.
5–2–08.	1 Weevil (legs only). 2 Small larvæ, possibly Tineid. Some buds.
9–3–07.	1 *Camponotus compressus.* 2 *Tanymecus hispida.* Some buds and vegetable matter.
20–2–09.	1 *Polyrachis simplex.* Some weevils legs. Buds and vegetable matter.
20–3–08.	1 *Tanymecus indicus.* Buds and vegetable matter.
29–3–09.	1 *Phidole malinsi ?* 3 *Tanymecus* sp. Some buds and vegetable matter.

Summary.—Of 12 insects taken by 15 birds, 9 are injurious and 3 neutral. Four birds took injurious insects, these being mostly weevils though ants and small caterpillars occurred, and 3 neutral. All contained vegetable matter : 3 Ficus fruit.

Natives have informed me on several occasions that this bird damages mangoes to some extent when the fruit is nearly or quite ripe.

Ixulus.—Minute insects and larvæ. Jerd. B. I., II, 217.

232. *I. flavicollis.*—Yellow-naped Ixulus. Hunts among leaves for insects. B. N. H. S. J., XIX, 120. Minute insects and larvæ.

LIOTRICHINÆ.

Liothrix, Cutia, Shrike-Tits, Ioras, Chloropsis, Blue-bird, Sultan bird, Minlas, Warbler Tit, Firecaps, Spotted-wings, Hypocolius.

235. *Liothrix lutea.*—Red-billed Liothrix. Berries, fruit, seeds and insects ; apparently picks gravel off roads. Jerd. B. I., II, 251. Fruit and seeds as well as insects. A. S. B., LXVI, 614.

236. *Cutia nepalensis.*—Nepal Cutia. Fruit and insects. Jerd. B. I., II, 248.

Pteruthius : insects and berries. F. I., I, 224.

237. *P. erythropterus.*—Red-winged Shrike-Tit. Fruit and soft insects. Jerd. B. I., II, 245.

238. *P. æralatus.*—Tickell's Shrike-Tit. Searches moss and lichens, at tops of trees for insects. Jerd. B. I. A. S. B., 69, 109.

239. *P. melanotis.*—Chestnut-throated Shrike-Tit. Fruits and seeds ; others had only eaten insects. Jerd. B. I., II, 247.

241. *P. xanthocloris.*—Green Shrike-Tit. Fruits and seeds ; others had only eaten insects. Jerd. B. I., II, 247.

243. *Ægithina tiphia.*—Common Iora. Various insects and larvæ, spiders, etc. Jerd. B. I., II, 102. Insects found among leaves. F. I., I, 231.

Stomachs examined :—

12–2–07.	1 *Mesomorpha villiger.*
	3 *Myllocerus discolor.*
	Other coleopterous ely
	2 Spiders.
	Remains of some buds ?
13–3–09.	5 *Myllocerus discolor.*
	1 „ *blandus.*
	3 *Tanymecus hispida.*
3–4–07.	4 *Camponotus compressus.*
	2 *Aphodiids.*
	1 Hydrophilid.
12–4–08.	3 *Tanymecus hispida ?*
	1 *Tanymecus* sp.
	2 *Myllocerus* sp.
	3 *Scymnus nubilans.*
	1 *Clanis soror.*
	3 *Aphodiids.*
12–4–08.	4 *Rhyssemus germanus.*
	2 *Aphodiids.*
5–6–07.	5 *Rhyssemus germanus.*
	1 *Opatrum* sp.

Summary.—Of 55 insects taken by 6 birds, 4 are beneficial, 18 injurious, and 33 neutral. One bird took beneficial insects, 3 injurious and 5 neutral. Only 1 bird took vegetable matter.

246. *Myzornis pyrrhura.*—Fire-tailed Myzornis. Small insects. Jerd. B. I., II, 264.

247. *Chloropsis aurifrons.*—Gold-fronted Chloropsis. Insects principally. F. I., II, 235. Entirely insectivorous; hunts tall shrubs (red-flowering) for insects of all kinds (two leguminous seeds which were probably taken for beetles, which were crowding on the plant); also white ants. B. N. H. S. J., VIII, 8. Insects on tea when flowering. B. N. H. S. J., 10. Catching insects on wing like Bee-eaters or Shrikes. B. N. H. S. J., XVII, 188. In captivity feeds principally on fruit, but it is also an insect-eater and takes grasshoppers greedily. B. N. H. S. J., XVII, 789.

248. *C. malabarica.*—Malabar Chloropsis. Fruit and insects, principally insects. Jerd. B. I., II, 99.

249. *C. hardwickii.*—Orange-bellied Chloropsis. Almost entirely insectivorous; individual preference once shown to young oranges. In captivity plantains, insects especially grasshoppers, bees and wasps. B. N. H. S. J., VIII, 9. Often among cherry bloom. B. N. H. S. J., XVII, 789.

252. *C. jerdoni.*—Jerdon's Chloropsis. Fruit and insects. Jerd. B. I., II, 98. Bomb. Gaz., Ahmedabad, IV, 75.

254. *Irena puella.*—Fairy Blue-bird. Chiefly fruit of various kinds, but I daresay may take caterpillars occasionally. Jerd. B. I., II, 105. Principally fruit. F. I., I, 241. Partly of insects, partly of berries. B. N. H. S. J., XV, 262.

255. *Melanochlora sultanea.*—Sultan Bird. Insects chiefly; exceedingly fond of caterpillars and occasionally takes pulpy berries. Jerd. B. I., II, 282. Minla insects on trees. Jerd. B. I., II, 255.

261. *Psaroglossa spiloptera.*—Spotted-wing. Hutton-berries. Jerd. B. I., II, 336. F. I., I, 250.

Insectivorous. Insects in flowers of Simul tree. B. N. H. S. J., X, 459.

262. *Hypocolius ampelinus.*—Grey Hypocolius. Chiefly fruits; legs and wings of beetles, but does not take them on ground or on wing. B. N. H. S. J., XII, 761.

BRACHYPODINÆ.

Bulbuls.

Bulbuls feed largely on fruit, but also devour insects, in doing which they do not use their feet to hold their prey, but depend entirely on their beaks. A. S. B. J., LXVI, 614. Common and Green Bulbuls feed on white ants. B. N. H. S. J., X, 303. Common Bulbul feeds on worms. B. N. H. S. J., VIII, 210.

In the Shevaroys (Madras), a species of Bulbul, or perhaps more than one species, does some considerable damage to the coffee berries in some plantations during the cold months, October to March, when the berries are ripening. The attacks do not, however, occur year after year but seem to be regulated by the bird's food supply in its usual haunts. The coffee is attacked when the bulbul's food supply fails elsewhere.

Criniger.—Feed on fruit, berries varied with insects. F. I., I, 255.

263. *C. flaveolus.*—White-throated Bulbul. More exclusively fruit than other bulbuls. B. N. H. S. J., IV, 4. Entirely on fruit. Jerd. B. I., II, 84.

267. *Tricholestes criniger.*—Hairy-backed Bulbul. Insects appear to be the principal food. F. I., I, 258.

269. *Hypsipetes psaroides.*—Himalayan Black Bulbul. Nectar in flowers of Rhododendron arboreum, from which it also obtains insects. It is fond of wild Mulberries and Cherries. Fruits and berries. Jerd. B. I., II, 78.

Fruit and nectar contained in the large flowers of such trees as Rhododendrons. F. I., I, 261.

Although the berries of *Viburnum foetens* are the staple food of this bulbul, it is, to a great extent in the breeding season at any rate, insectivorous, and is often seen fly-catching from the tree tops in the evenings. B. N. H. S. J., XIX, 146.

270. *H. concolor.*—Knocks off wild cherry flowers. A. S. B., LXIX, 110.

271. *H. ganeesa.*—Southern Indian Black Bulbul. Stony fruit (Sykes). Jerd. B. I., II, 79. Fruit and berries. F. I., I, 262.

Hemixus.—Chiefly fruit eaters. F. I., I, 263.

272. *H. flavala.*—Brown-eared Bulbul. Berries and insects. Jerd. B. I., II, 81.

275. *H. macclellandi.*—Rufous-bellied Bulbul. Chiefly on fruit. Jerd. B. I., II, 80. On berries, probably entirely vegetarian. B. N. H. S. J., VIII, 4.

277. *Alcurus striatus.*—Striated Green Bulbul. Chiefly on fruit, sometimes on insects. Jerd. B. I., II, 82.

Molpastes feed mostly on fruit, and they are always to be found on fruit bearing trees in large numbers. F. I., I, 267.

278. *Molpastes hæmorrhous.*—Madras Red-vented Bulbul. Chiefly on fruits, but sometimes on insects on the ground. It destroys various buds and blossoms also, and is very destructive to peas, strawberries, Brazil cherries (Physalis peruviana) and other soft fruit. Jerd. B. I., II, 95-96. In a vegetable garden it is very destructive. Bomb. Gaz., Cutch, Vol. X, p. 75.

279. *M. burmanicus.*—Burmese Red-vented Bulbul. White ants on wing. B. N. H. S. J., VII, 413. They probably come up to the hills for nesting purposes, and to feed on the wild raspberries which fruit in such profusion about this time. B. N. H. S. J., XIX, 121.

282. *Molpastes bengalensis.*—Bengal Red-vented Bulbul. On toddy pots on palms. B. N. H. S. J., XIII, 624.

Stomachs examined :—

12-1-07.	Ber (*Zizyphus jujuba*) fruit.
	Ficus fruit.
12-1-07.	Ber (*Zizyphus jujuba*) fruit.

Stomachs examined :—contd.

8–2–09.	15 *Myllocerus blandus.*
	26 „ *discolor.*
10–2–09.	*Ficus* only.
13–2–07.	Ber fruit (*Zizyphus jujuba*).
	Ficus fruit.
19–2–07.	5 *Camponotus compressus.*
	3 *Myllocerus blandus.*
	2 *Opatrum* sp.
	Ficus fruit.
29–2–08.	*Ficus* fruit.
	A few grass and weed seeds and leaves.
29–2–08.	1 *Myllocerus* sp.
	Ficus fruit, grass and weed seeds.
12–3–09.	*Ficus* fruit.
12–3–09.	*Ficus* fruit.
15–3–07.	*Ficus* fruit.
15–3–07.	*Ficus* fruit.
12–4–08.	1 *Chrotogonus.*
	1 *Oxya* sp. ?
	3 *Opatrum* sp.
	Ficus fruit, grass and weed seeds and leaves.
12–4–08.	3 *Camponotus compressus.*
	2 *Opatrum* sp.
	1 *Himatismus* sp.
	A little *Ficus* fruit.
12–4–08.	*Ficus* fruit.
12–4–08.	1 Caterpillar.
	Ficus fruit.
20–5–08.	Pipal (*Ficus religiosa*) fruit.
	Grass and weed seeds and leaves.
28–5–08.	1 *Camponotus compressus.*
	2 *Scleron orientale.*
	1 Carabid head.
	5 *Myllocerus* sp.
	1 *Cydnus nigritus.*
	Ficus fruit.
3–6–09.	*Ficus* fruit.
10–6–07.	*Ficus* fruit.
10–6–07.	2 *Chrotogonus* sp.
	5 *Myllocerus* sp.
	2 Caterpillars (Geometrid).
	Ficus fruit.
20–6–08.	*Ficus.*
20–6–08.	1 *Onthophagus spinifer.*
	3 *Myllocerus* sp.
	1 *Catharsius sabæus.*
	Grass seeds, &c.
22–6–08.	2 *Chrotogonus* sp.
	1 *Apis indica* (worker).
	1 „ *florea* (worker).
	1 *Myllocerus* sp.
	Several Coleopterous elytra.

	1 Dynastid (? sp.).
	1 Moth's head.
	1 Caterpillar.
	Some *Ficus* fruit.
8-7-08.	[A young bird.]
	Young shoots of grass and of ? maize
21-7-08.	[A young bird.]
	Ficus fruit.
21-7-08.	1 *Myllocerus discolor.*
	Ficus fruit.
6-8-08.	6 *Myllocerus discolor.*
	6 Fruits (? Nim).
	Some grass blades, &c., seeds.
24-8-08.	1 *Myllocerus* sp.
	3 *Opatrum?*
	1 *Penthicus* sp.
	1 *Himatismus* sp.
	Ficus fruit.
6-9-08.	*Ficus* fruit.
6-9-08.	*Ficus* fruit.
3-10-07.	Some *Ficus.*
	Stomach practically empty.
3-10-07.	1 *Phidole malinsi.*
	14 *Myllocerus maculosus.*
	1 *Myllocerus* ? sp. ?
	1 *Gymnopleurus miliaris?*
4-10-08.	1 *Camponotus compressus.*
	Vegetable matter including Ficus.
4-11-08.	1 *Chrotogonus* sp.
	1 *Camponotus compressus.*
	Banyan fruit (Ficus).
21-11-07.	*Ficus* fruit.
21-11-07.	*Ficus* fruit.

Summary.—Of 129 insects taken by 37 birds, 3 are beneficial, 96 injurious and 30 neutral.* 16 birds took insects and of these, 2 took beneficial ones, 14 injurious and 9 neutral, 2 had eaten insects only.

35 of the 37 birds took vegetable food, 21 of these containing vegetable matter only. Ficus fruit is largely eaten and was found in 31 birds, 14 having fed only on this fruit. 3 took 'ber' fruit, 1 nim and 1 maize shoots.

The food of this bird is undoubtedly more vegetable than animal, and consists to a very great extent of fruits of Ficus of several species, ber, mulberries, also grass and weed seeds and leaves. Insects are taken to a certain extent, chiefly weevils. As is usual

* I have seen this bird eating *Gryllotalpa africana*, which does not appear in the above list.—T. B. F.

with such birds that are more or less omnivorous, termites when the flying ones emerge are taken: grasshoppers and ants are also occasionally eaten. The food of the young, as far as I have noted, is purely vegetable, consisting of tender shoots and Ficus fruit. It is said to do some damage to peaches, loquats, pomegranates, and even to eat plantains in orchards and gardens.

One bird shot in 1907 contained some indigo seeds.

284. *M. leucogenys.* White-cheeked Bulbul. Seeds, fruit and insects. Jerd. B. I., II, 91.

285. *M. leucotis.* White-eared Bulbul. In captivity, on grasshoppers and meal worms. B. N. H. S. J., XIII, 699. At Kasauli, I saw this species taking ants off the stems of pine trees, scrambling about the stems while doing so. I also saw it feeding on two species of red mountain berries near Kalka.

288. *Otocompsa emeria.* Bengal Red-whiskered Bulbul. Chiefly on fruit and seeds on the Neilgherries, robbing the gardens of peas, strawberries, etc.; now and then it takes insects. Jerd. B. I., II, 93. White-ants on the wing. B. N. H. S. J., VI, 264.

290. *O. flaviventris.* Black-crested Yellow Bulbul. Chiefly fruits. Jerd. B. I., II, 83.

292. *Spizixus canifrons.* Finch-billed Bulbul. Stomachs full of insects, chiefly small beetles, and a few hard seeds, soft winged insects, small moths, metallic winged flies. B. N. H. S. J., VI, 12. Insect feeder, and does not live entirely on fruit. A. S. B., XXXIX, II, 106.

295. *Iole icterica.* Yellow-browed Bulbul. Fruit; possibly insects may be taken. Jerd. B. I., I, 289.

303. *Pycnonotus gularis.* Ruby-throated Bulbul. Chiefly on fruits and berries. Jerd. B. I., II, 88.

305. *P. luteolus.* White-browed Bulbul. Entirely on fruits. Jerd. B. I., II, 85.

310. *Micropus melanocephalus.* Black-headed Bulbul. Almost entirely fruit. Two woodlice, small green grasshoppers, white-ants. B. N. H. S. J., VIII, 4.

313. *M. phœocephalus.* Grey-headed Bulbul. Chiefly on stony fruit. Jerd. B. I., II, 89.

Crateropodidæ are divided into 6 sub-families which must be dealt with more or less separately.

The *Crateropodinæ*, with the exception of some species of the two genera *Argya* and *Crateropus*, are confined to hill tracts and are not found on the plains. They live in brushwood or jungle and feed on insects found under leaves, etc., on the ground. Some take fruits and may possibly take them from bushes where bush fruit is grown, but in most cases the fruit is picked up from the ground. They are probably all beneficial.

The *Timeliinæ* are almost entirely hill birds, a few species only occurring on the plains. Their food consists chiefly of insects. The *Brachypteryginæ* and *Sibiinæ* are also hill birds; of the latter *Zosterops*, probably injurious, occurring in the plains. *Liotrichinæ* feed on insects, fruit and berries. The plains species of *Aegithina* are mostly insectivorous, as also of *Chloropsis*, while *Irena* is more frugivorous.

Brachypodinæ. The Bulbuls are both frugivorous and insectivorous, and at times some of these are injurious to fruit orchards, though as a class they are beneficial. *Molpastes*, *Pycnonotus* and *Micropus* all occur in the plains. In the hills some species are injurious at times to coffee plantations.

As a family these birds are beneficial, but at all times those species that take fruit, and a few that take berries, are liable to make inroads on fruit orchards and, in special cases, on coffee plantations.

SITTIDÆ.

The Nut-hatches feed on insects and hard fruits, such as nuts. F. I., I, 299.

The Nut-hatches seldom seek their food upon the ground, but search every cranny and dig in rotten wood for insects, their larvæ and so forth, or collect nuts, acorns, beech-mast and seeds. E. B. C. N. H., 538.

315. *Sitta himalayensis.* White-tailed Nut-hatch. Insects off bark, occasionally one in the air. Jerd. B. I., 385.

321. *Sitta castaneiventris.* Chestnut-bellied Nut-hatch.

Stomachs examined—

11-2-08.	1 Small Elaterid.
	1 Hemipterous scutellum.
	2 Ants wings.
	2 Spiders.
27-5-07.	23 *Cremastogaster subnuda.*
	2 Pieces of wing ?
	1 Spider.
28-6-08.	5 Coleoptera. (*Myllocerus* sp. ?).
	1 Noctuid's head.
	1 Tabanid.
29-6-08.	9 Small Elaterids.
	1 *Myllocerus* sp.
30-6-08.	7 Weevils.
	1 Hemipterous scutellum
12-6-08.	5 Elaterids.
	1 *Mesomorpha villiger.*
	1 Jassid.
	1 Termes sp.
	Much disintegrated coleopterous remains.
9-7-08.	11 Hydrophilids.
	2 Jassids.
30-10-08.	1 *Myllocerus* sp.
	3 Weevils.
	4 Hemipterous heads.
	Remains of other coleoptera unidentifiable.
12-11-08.	5 Small Elaterids.
	1 *Myllocerus discolor.*
	2 *Tanymecus* sp.
	Remains of Jassids, and some small coleoptera probably Aphodiids.

Summary.—Of 89 insects taken by 9 birds, 26 are injurious and 63 neutral. 7 birds took injurious insects and 8 neutral. 2 birds took spiders.

323. *Sitta leucopsis.* White-cheeked Nut-hatch. Chiefly on seeds of *Pinus gerardiana.* F. I., I, 306.

325. *Sitta frontalis.* Velvet-fronted Blue Nut-hatch. Various small insects and larvæ off bark. Jerd. B. I., I, 389.

The nest of this species was found in a sissoo tree about 8 feet from the ground. The young were fed largely on small caterpillars and

Hemiptera of various species. Two of the insects fed on one occasion were undoubtedly the red cotton bug [*Dysdercus cingulatus*].

This is the only occurrence I have noted of this species at Pusa. The nest was found on March 23, 1907.

The *Sittidæ* are beneficial.

DICRURIDÆ.

Drongos.

The food consists of insects of all kinds which are captured on the ground, on leaves or flowers, on the backs of cattle, or at times upon the wing, individuals often returning to their perches like fly-catchers. E. B. C. N. H., 529.

They feed habitually on the wing, darting from one perch on a tree into the air to catch an insect and returning to the same or an adjoining branch. The Dicruri frequently perch on the backs of cattle. F. I., I., 308. All drongos hawk insects in the air. Imp. Gaz., I, 242.

Species which occur in forest country feed more on the wing—probably almost entirely so—than species occurring in more open country. *D. ater*, if anything, feeds more on the ground than on the wing, whilst *Chibia hottentotta* feeds still less habitually on the wing than the other drongos, finding most of its food by hunting on trees for insects.

327. *Dicrurus ater*. It feeds chiefly on grasshoppers and crickets, which as Sundeval remarks, appear to be the chief insect-food for birds in India. Also now and then on wasps or bees, dragon-flies and occasionally moths or butterflies. It generally seizes its insect-prey on the ground, or whips one off a stalk of grain, frequently catching one in the air. Winged termites and locusts. Jerd., B. I., I., 428.

Stomachs examined—

11-1-08.	2 *Myrmecocystus setipes.*
	4 *Opatrum* sp.
	3 Cutworms.
15-1-08.	1 *Gryllotalpa africana.*
	Some remains of beetles.

Stomachs examined—contd.

25-1-08.	1 *Myrmecocystus setipes.*
	3 *Opatrum depressum.*
	5 Small caterpillars.
9-2-08.	2 *Gryllotalpa africana.*
	1 *Gryllodes melanocephalus.*
	3 *Opatrum* sp.
	15 *Rhyssemus germanus.*
	1 Small Cetoniid.
12-2-09.	1 *Camponotus compressus.*
	2 *Œcophylla smaragdina.*
	6 *Myllocerus discolor.*
	2 Cutworms (*A. spinifera*).
15-2-08.	2 *Chrotogonus* sp.
	2 *Opatrum* sp.
	5 Noctuid caterpillar.
28-2-08.	2 *Opatrum* sp.
	6 *Opatrum depressum*
	1 *Scleron orientale.*
	1 Moth.
28-2-08.	1 *Chrotogonus* sp.
	1 *Gryllotalpa africana.*
	5 Melolonthid larvæ.
	5 Cutworms.
10-3-08.	2 *Myllocerus discolor.*
	5 Small Carabids.
	5 Cutworms.
	3 *Lygæus* sp.
12- -09.	4 *Scolia quadripustulata.*
12-3-09.	3 *Scolia quadripustalata.*
	1 Noctuid (sp. ? wing only).
25-3-08.	1 *Gryllotalpa africana.*
	1 *Myrmecocystus setipes.*
	16 Small Geometrid ? larvæ.
	3 Hemiptera.
	1 *Monophlebus stebbingi.*
2-4-08.	1 *Chilomenes sexmaculata.*
	1 *Spodoptera mauritia.*
	2 Pyralids ?
	1 Spider.
11-4-08.	2 *Chrotogonus* sp.
	2 *Myllocerus* sp.
	5 Small caterpillars.
11-4-08.	3 *Myllocerus discolor.*
	1 „ *maculosus.*
	2 Small moth's heads.
	1 „ geometrid caterpillar
20-4-09.	3 *Gastromargus* sp.
	1 *Chrysis* sp.
14-5-08.	1 Remains of a cricket.
	6 *Chilomenes sex-maculata.*
	1 Small caterpillar.
	Remains of ? beetles and ants.

Stomachs examined—contd.

23–5–08.	1 *Myllocerus* sp.
	Remains of *Myllocerus* sp. 4, and some ants (6) probably. *Camponotus compressus.*
31–5–08.	6 *Myrmecocystus setipes.*
17–6–08.	1 *Termes* sp.
	3 *Myllocerus?* sp.
	2 Noctuid moths.
	4 Cutworms.
1–7–08.	1 *Atractomorpha crenulata?*
	3 *Termes* sp.
	3 *Opatrum* sp.
11–8–08.	1 *Chrotogonus* sp.
	3 *Stizus vespiformis.*
	1 Melolonthid larva.
21–10–08.	1 *Brachytrypes achatinus.*
	1 *Gryllodes melanocephalus?*
	Other remains, probably of both ants and beetles.
11–11–08.	1 *Oniticellus pallipes.*
	1 *Onthophagus* sp.
	2 *Heteroderes* sp.
	1 *Pœderus variicornis.*
	1 Carabid head.
2–12–08.	1 *Dorylus* sp.
	2 *Œcophylla smaragdina.*
	3 *Myllocerus* sp.
	1 *Astycus* sp.
	1 *Camponotus compressus.*
	3 Cutworms. *Agrotis* sp.
11–10–08.	2 *Camponotus compressus.*
	1 *Onthophagus spinifer.*
	1 Melolonthid larva.
	2 Elaterid grubs.
12–10–08.	2 *Œcophylla smaragdina.*
	5 *Camponotus compressus.*
	3 *Opatrum* sp.

Summary.—Of 234 insects taken by 27 birds, 14 are beneficial, 133 injurious and 87 neutral. Twenty-three birds took injurious insects, 4 beneficial and 18 neutral. One took a spider.

The food of the young appears to be much the same as that of the adult. I have not, however, examined any very young birds.

The following are records of the stomach-contents of young birds soon after they had left the nest; they were capable of flying, though not of obtaining their own food, apparently. The parents were feeding them :—

12–6–08.	1 *Brachytrypes achatinus.*
	2 *Opatrum* sp.
	2 Small larvæ (cutworms).
12–6–08.	2 *Brachytrypes achatinus.*
	5 Broken caterpillars. Possibly more.
28–6–08.	2 *Gryllotalpa africana.*
	2 *Nezara viridula.*
	2 Caterpillars.
	Other unidentifiable matter probably the remains of more caterpillars.
28–6–08.	1 *Chrotogonus* sp.
	2 *Myllocerus maculosus.*
	1 Tenebrionid.
	Caterpillar remains ?

Summary.—Of 22 insects in 4 birds, 19 are injurious and 3 neutral. None are beneficial. Four birds took injurious insects, 2 neutral and none beneficial.

During July 1908 whenever flying termites were emerging, King-crows were noticed to be very busy catching these insects, and fed large quantities of them to the young. One evening I watched two young birds being fed, apparently entirely on these insects, and in half an hour counted 23 visits made by the parent birds to their two young : the insects captured were almost certainly entirely termites. This is the only occasion on which I have noticed more than one insect brought at one time by this species to its young. The old birds continually fed one bird and then went to the other and fed it also without hawking between whiles. This is in all probability due to the fact that flying termites are exceedingly easy to capture. It is extremely unlikely that the termite is broken up and part fed to one bird and part fed to the other. From the stomach contents recorded above, it is, however, worth noticing that soft insects are almost entirely fed, and in all probability when the young are in the nest the food consists almost entirely of caterpillars and grubs.

Total Summary.—Of 257 insects taken by 31 birds, 37 are beneficial, 177 injurious and 43 neutral. Injurious insects were taken by 29 birds, beneficial by 13 and neutral by 8.

Conclusion.—Beneficial.

The King-crow is quite one of the most widely distributed birds in India, is found at elevations over 5,000 feet and is one of the com-

monest and most interesting birds of the plains. It can be seen almost anywhere in open country, preferring cultivated areas and grass lands rather than jungle, though it occurs very commonly in the thinner jungles. It is one of the first three birds one notices when coming across India. The King-crow (*D. ater*) the common Indian bee eater (*M. viridis*) and the blue jay (*Coracias indica*), show a remarkable preference for perching on telegraph wires from which they can get a very good view of any insect flying by or on the ground. It is a very easy bird to observe in the plains, as it is so common, and not at all shy. Curiously enough, in the hills (Kasauli), I found it comparatively hard to get near for close observations, though fairly common there.

The King-crow is almost entirely insectivorous, capturing its prey in the air, on the ground, and even skimming the surface of pools and rivers in pursuit of Ephemerids and Hydrophilids. From the different orders of insects known to form its food, practically no insect comes amiss to it. Size of the insect is apparently of little matter, since we find the King-crow takes insects varying in size from those as large as the Bombay Locust (*Acridium succinctum*) down to some of the smallest Histerids. No preference seems to be shown to any one species or family of insects, though I have certainly observed three cases of apparent dislike. Two of these occasions occurred with a whitish Fulgorid—*Lawana conspersa*. In each instance the bird swooped at the insect and when almost up to it swerved off and left it. The insect was flying slowly in open jungle and could have been caught easily; it does not smell offensively, nor has the colouration anything to do with the case, for I have seen the King-crow catching *S. auriflua* (the White Cane Borer) on the wing flying over oats, and once the common white butterfly *Belenois mesentina*. The second case was noticed at Indigo mahai, when the King-crows were round the vats in numbers, capturing beetles, chiefly Tenebrionids (*Opatrum* sp.) and weevils, of which *Myllocerus maculosus* and *M. blandus* were the commonest species, small moths and probably spiders, though these are not often taken. Dragon-flies

of several species were present in swarms, but the birds never touched them, no doubt preferring insects more readily captured. On only one occasion have I found the King-crow take a dragon-fly. Other insectivorous birds, notably Meropidæ (*M. viridis* and *philippinus*), have frequently been observed to take dragon-flies, and there seems to be no obvious reason why the King-crow should not do so, except that insects on the ground may be captured more readily than on the wing, though this seems hardly applicable to so active a bird as the King-crow.

The King-crow captures insects in various ways, some of them very ingenious ones. The usual method is to sit on an exposed bough of a tree, a post—telegraph wires are always used when available and when no mynahs are about—and in fact any place from which a good view of the surrounding country can be obtained. When an insect flies by, the bird swoops at it, returning as often as not to a similar perch to kill and eat its capture. Sometimes the insect is taken to the ground and eaten. Insects are taken on the ground almost, if not quite, as often as on the wing, the bird remaining on the ground for a few seconds to eat the insect. Though great numbers of insects are taken on the ground, it is a noticeable fact that ants are practically never taken. Hovering around bushes and low plants in quest of insects is another common method, and on more than one occasion I have seen a King-crow apparently deliberately brush against the outer twigs of a sissoo, capturing small moths (Geometrids and Pyralids), as they flew out on being disturbed. During cultivation operations, especially ploughing, these birds may be seen in large numbers over the fields. At such times they sit on any large lump of earth and pick up any caterpillar or grub which is turned up: naturally the food then almost entirely consists of cutworms (larvæ of *Agrotis ypsilon*, and other Noctuids of the same class), beetles and crickets to a less extent, and also Melolonthid grubs. On one occasion 35 King-crows were observed in one field which was being ploughed. At such times they do not congregate together but are scattered over the field in pairs or singly. When rubbish is being filled or emptied, King-crows are

almost invariably present, taking grubs and insects of all sorts. On grass lands its favourite perch is on the backs of cattle, sheep or goats, and sometimes ponies, from which frequent sallies are made at insects disturbed by the cattle. It is said flies are captured at such times, but at present I have taken no diptera from the King-crow's intestines even after the bird obtained had been observed apparently catching flies in this way. If a flock of Mynahs (*A. tristis*)—I have seldom seen a King-crow accompanying the Pied Mynah (*Sturnopastor contra*)—happens to be working a grass field, a King-crow is almost certain to be close by or among them and captures insects put up by the Mynahs. Insects are then as a rule taken on the wing, though grasshoppers are taken on the ground and the efforts of the bird to capture insects if the grass is at all long are very amusing: he is by no means active on the ground under the best circumstances. If the Mynahs move off to fresh hunting grounds, the King-crow accompanies them at some distance behind. The fact that the King-crow does not accompany *S. contra* so much is, I believe, partly due to the fact that that species does not work such long grass as *A. tristis*, and the shorter grass lands do not contain so many insects. As a rule, the Mynah and the King-crow get on fairly well together, and the Mynahs never seem to resent his presence, in spite of the fact that the King-crow is continually chasing the Mynahs and robbing them of some insect. There is a very interesting account in the *Bombay Natural History Society's Journal*, XVI, pp. 364-366 (D. Dewar) of this commensalism of the King-crow and the Mynah in Madras and the same habits can be observed throughout Bengal, in the Central and United Provinces and the Punjab, and there is no reason to suppose one may not observe the same whenever these two birds occur. Again, in company with Mynahs, King-crows frequently accompany cattle, etc., walking through grass-lands and open jungle, taking insects as they are put up. Two species of moths taken under such conditons are *Trigonodes hyppasia* and *Plecoptera reflexa*: grasshoppers and moths form the greater proportion of insects taken under these conditions. If the cattle are going in one direction, the birds keep more or less up

with the leading cattle. I have seen sixteen birds with twenty-five cattle feeding close together; not unfrequently quarrels arise, but with King-crows this is never a serious affair, one or other soon moving off, though as a rule not far.

At any place where grass lands are being burnt off, King-crows, in numbers, in company with other birds (such as Kites, Blue Jays and Wagtails) are always present, flying after moths and various insects almost through the flames.

If the insect captured is a large one and especially in the case of moths, it is generally broken up to some extent before being eaten. Moth's wings are often ripped off. This fact affords very good proof that field observations are essential for accurate determination of a large proportion of some birds' food, and that no bird's food-material can be put down as only consisting of certain kinds of insects, etc., until very thorough field observations have been made under every possible condition.

The following table shows the number of insects taken from birds examined during 1907 and 1908, all obtained at Pusa. This table probably includes about three-fourths of the total number of insects in the birds at the time of examination. It is impossible to obtain accurate figures, as in all cases numbers of insects are completely broken up, very often nothing more than the elytra of beetles or heads of moths being visible among the stomach-contents—

Year.	No. of birds.	*Orthoptera.*	*Lepidoptera.*	*Coleoptera.*	*Neuroptera.*	*Hemiptera.*	*Hymenoptera.*	Total.
1908	22	11	96	76	4	9	...	218
1907	31	22	121	79	29	20	1	282

Giving % of
1908 9·94 insects in each bird.
1907 9·1.

Imagines of *Lepidoptera* are not apparently taken to so great an extent as *Coleoptera*, the numbers shown in the table being composed of larvæ to the extent of about two-thirds. Very few larvæ of beetles are taken, these being the larvæ of Melolonthids (chafers)

turned out of rubbish or picked up during cultivation operations. No doubt, many more imagines of *Lepidoptera* are taken than the figures show, the inaccuracy of these being due to the fact that moths are broken up very much before being eaten.

The *Neuroptera* practically consist only of winged termites.

From the above account of insects eaten by the King-crow, it will be seen that very few beneficial insects are taken. *Chilomenes sexmaculata* has only been found in one bird, this bird containing the remains of six of these insects.* They were captured in February over a wheat crop, *C. sexmaculata* being especially partial to the wheat aphis (*Siphonophora granaria*). One bird contained a wing of a dragon-fly, an insect which, if anything, is beneficial. (In England I have seen dragon-flies, I believe *Libellula quadratulata*, take two species of butterflies, *Brenthis euphrosyne* and *Pieris napi*.) Other small animals such as worms and spiders, both of which are beneficial, are taken occasionally. No special preference is shown to any species of beneficial insect, but undoubtedly they would be taken when met with. The vast quantity of injurious insects eaten completely counterbalances the fact that any beneficial ones are taken. Amongst the more important pests, the following are of the greatest economic importance:—Of *Orthoptera*, the Bombay locust (*A. succinctum*), grasshoppers notably *Chrotogonus*, ground grasshoppers which do vast damage to young crops, and various crickets. Of *Neuroptera*, termites. Of *Coleoptera*, *Cetoniids*, *Coprids* and the larvæ of *Anomala varians*, a common root pest. Of the Lepidoptera, agrotids and cutworms, *Sp. mauritia* and also *Scirpophaga auriflua*.

We may hence consider the King-crow to be as beneficial as a general insect feeder can be, and he should be encouraged in every possible way.

The powerful build of the King-crow eminently fits him for securing insects on the wing, but all the same he is very partial to grubs and caterpillars. His tail is far too long and cumbersome to allow him to make a practice of picking caterpillars off trees and

* But see also under date 14-5-08 in Table of Stomach-contents.—T. B. F.

bushes, and so he has to make use of such opportunities as are given him during ploughing operations, etc., for obtaining such food. To supplement these opportunities he often makes very good use of his fighting powers, and he generally selects the Hoopoe to rob. As a rule a Hoopoe eats a caterpillar whole, but should the caterpillar (or the earth-worm) happen to be a large one, or again if the Hoopoe has young and is making a collection of insects to take to the nest, the caterpillar is not eaten immediately. The King-crow will then swoop down on the Hoopoe and almost invariably steal the caterpillar. Hoopoes and King-crows often seem to have little quarrels, probably on this account alone.

The King-crow is a very pugnacious bird and attacks kites, crows, mynahs, etc., with great vigour. I once saw a King-crow settle on the back of a common kite. A similar event is also on record. He is particularly pugnacious during the breeding season and keeps all birds at a proper distance at that time and especially crows. In a fight he does not always get the best of it. I have seen him hustled by an *Oriolus melanocephalus*, and he has been "bustled by *Chloropsis aurifrons*." (B. N. H. S. J., VIII, 10). Again "numbers squat on the ground with mynahs and wag-tails (*M. borealis*)—constantly chasing the latter." (B. N. H. S. J., XVI, 486). As a rule, however, he gets on very well with Mynahs and does not attack or worry smaller birds than himself. The King-crow will often have a tussle with a Mynah over an insect, and this occurs when the King-crow is waiting near the Mynahs and picking up any insects that may be disturbed from the grass. I once saw a Magpie-robin playing with a mole cricket. A Mynah (*A. tristis*) suddenly flew down and captured the cricket, and began to peck at it. A King-crow then appeared and went for the Mynah, which skulked under a bush and then began to run round and round it. The noise made by these two birds soon brought another King-crow on the scene, and these two King-crows soon stopped the manœuvres of the Mynah, which dropped the cricket and flew off. The fight had attracted thirteen Hoopoes to the spot. Worms are often robbed from Mynahs.

Encouragement.—It is useless to try and make these birds breed anywhere, they are far too touchy at the breeding season. If their presence is desired on any crop, a few bamboos or sticks stuck in various places encourage the birds to a certain extent. This, however, I would not recommend on a cereal crop such as wheat, for the birds seem inclined under such conditions to take Lady-bird Beetles which are beneficial. These perches must be higher than the crop they are placed in. Among crops, such as maize, it is a very good plan to grow a few bajra plants, as these form an excellent post of vantage for the birds. These plants grow in some cases considerably higher than the maize. I have noticed in districts where this bajra is grown among maize that the King-crows always chose to sit on the bajra heads and were always more numerous in the fields where the bajra plants were growing.

All my efforts at trying to induce these birds to occupy artificial nests placed in trees have failed. Apparently they cannot be encouraged in this way.

328. *Dicrurus longicaudatus.*—Indian Ashy Drongo. Chief food: bees, bugs, and other insects. Jerd. B. I., I, 430. Butterfly. B. N. H. S. J., IX, 337.

In Cashmir very often robs the Hoopoe of its prey. Jerd. B. I., I, 392.

330. *Dicrurus cærulescens.*—White-bellied Drongo. Grasshoppers. B. N. H. S. J., IV, 313.

335. *Chibia hottentotta.*—Hair-crested Drongo. Apparently feeding on insects in flowers of *Bombax malabaricum;* wasps, bees, green beetles and rarely vetches (probably taken with an insect by mistake); also fruits. Jerd. B. I., I, 439. Insects in flowers, taking fewer on wing than other drongoes. F. I., I, 321.

340. *Dissemurus paradiseus.*—Larger Racket-tailed Drongo. Locusts and large insects. B. N. H. S. J., X, 610. Wasps. B. N. H. S. J., VIII, 21. Termites and other insects. B. N. H. S. J., XII, 392. Bees, wasps, beetles, dragon-flies, locusts and mantids. In

captivity raw meat, lizards, and almost any animal matter. Jerd. B. I., I, 435. Robs insects from other birds by imitating a harrier's cry and charging down on them. B. N. H. S. J., XV, 455.

D. paradiseus. D. platurus.—Termites. B. N. H. S. J., VII, 417. Drongos take termites. B. N. H. S. J., X, 303.

Other than for *Dicrurus ater* we have very little information on the food of the *Dicruridæ*. The different species have on the whole similar habits and these birds form one of the most, if not quite the most, beneficial group that we have in India.

CERTHIIDÆ.

Tree-Creepers and Wrens.

The food of creepers consists of insects and their larvæ, ants and spiders. Seeds of conifers occasionally vary the diet. E. B. C. N. H., 572. The tree-creepers feed on insects, especially on beetles and spiders, which they find in the crevices of the bark. Jerd. B. I., I, 380. The tree-creepers (*Certhia*) feed entirely on insects. F. I., I, 328.

Wrens (*Troglodytidæ*) hunt for insects, their larvæ and spiders among fallen leaves, in crevices of rocks and so forth; while they occasionally eat worms, molluscs, crustaceans and seeds. E. B. C. N. H., 521.

The true wrens feed on insects, and occasionally seeds. Jerd. B. I., I, 491.

348. *Tichodroma muraria.*—Wall-creeper. Chiefly spiders and *Coleoptera*. Jerd. B. I., I, 383. Chiefly spiders and insects. F. I., I, 335.

353*a*. *Elachura hoplonota.*—Plain Brown Wren. Ants, small bright beetles on orchid flowers. B. N. H. S. J., VII, 319.

Pnœpyga.—Insects and seeds. Jerd. B. I., I, 488.

SYLVIIDÆ.

Warblers.

The majority feed solely on insects, a very few on flower buds, and even on fruit. Jerd. B. I., II, 113.

Sylviinæ live on insects and their larvæ, small molluscs and fruit, the first named being either caught in the air or sought upon the leaves and branches. E. B. C. N. H., 517.

360. *Locustella certhiola.*—Pallas' Grasshopper Warbler. Entirely on insects. Jerd. B. I., II, 160.

362. *L. straminea.*—Turkestan Grasshopper Warbler. Entirely insects. Jerd. B. I., II, 160.

363. *Acrocephalus stentoreus.*—Indian Great Reed-warbler. Grasshoppers and other insects among grass, crops and vegetables. Jerd. B. I., II, 155.

366. *A. dumetorum.*—Blyth's Reed-warbler. Like the others entirely on insects. Jerd. B. I, II, 6. Bushes for insects. B. N. H. S. J., XIII, 625.

374. *Orthotomus sutorius.*—Indian Tailor Bird. Various insects, chiefly ants, cicadellæ and various small larvæ off bark and leaves. Jerd. B. I., II, 166.

Stomachs examined—

10–2–09.	1 Tenebrionid.
	1 Hemipterous scutellum.
	Other insect-remains unidentifiable.
10–2–09.	1 Aphodiid.
	2 Coleopterous elytra.
15–2–09.	4 *Polyrachis simplex.*
	1 Coleopterous elytron.
	Other insect-remains unidentifiable.
24–2–09.	2 *Myllocerus blandus.*
	1 Small weevil.
	1 Dipteron.
	Other insect-remains unidentifiable.

Summary.—Of 14 insects taken by 4 birds, 3 are injurious, and 11 neutral. One bird took injurious insects and all took neutral.

381. *Cisticola cursitans.*—Rufous Fantail Warbler. Often insects on ground, among corn, etc.; ants, larvæ of grasshoppers and various other small insects. Jerd. B. I., II, 175.

Stomachs examined—

4-4-07.	3 *Cryptorhynchus sp.*
	4 Small weevils.
15-5-08.	1 *Phidole malinsi.*
	4 Weevils sp. ?
	3 *Aphis sp.*
	Some vegetable matter.
21-5-07.	1 *Chrotogonus sp.*
	2 Ephemerids.
	3 Small weevils.
31-6-09.	1 *Tryxalis sp.*
	1 *Mesomorpha villiger.*
	2 Small Lepidopterous larvæ.

Summary.—Of 27 insects taken by 5 birds, 23 are injurious and 4 neutral. Four birds took injurious insects and 3 neutral.

382. *Franklinia gracilis.*—Franklin's Wren-warbler. Minute insects in flowers. Jerd. B. I., II, 172.

389. *Megalurus palustris.*—Striated Marsh-warbler. Chiefly grasshoppers and *Coleoptera.* Jerd. B. I., II, 71.

390. *Schœnicola platyura.*—Broad-tailed Grass-warbler. Small insects. Jerd. B. I., II, 73.

394. *Hypolaïs rama.*—Syke's Tree-warbler. Insects on trees and in air. Jerd. B. I., II, 189.

Sylviinæ.—Warblers. Less insectivorous than other warblers, most eating freely buds, flowers and fruits. Jerd. B. I., II, 207.

399. *Sylvia jerdoni.*—Eastern Orphean Warbler. Various insects, grubs, and caterpillars, and also on flower buds. Jerd. B. I., II, 209.

401. *S. althæa.*—Hume's Lesser White-throated Warbler. Pupæ of ants. Jerd. B. I., II, 209.

402. *S. affinis.*—Indian Lesser White-throated Warbler. Insects and flower buds. Jerd. B. I., II, 219.

Phylloscopinæ.—Grass Warblers. Exclusively insectivorous, feeding on minute insects, flies, cicadellæ, etc., etc., on leaves, or caught in the air. Jerd. B. I., II, 187.

405. *Phylloscopus affinis.*—Tickell's Willow-warbler.

8–2–08. Legs of a small weevil.
Other insect remains (*Coleoptera* only).

407. *Phylloscopus tristis.*—Brown Willow-warbler. Insects in air and in sand of rivulet. Jerd. B. I., II, 187.

Stomachs examined—

December, 1907. } 7 Specimens.
January, 1908. }

These birds contained—
7 Small Staphylinids.
1 Small Elaterid.
7 Small Lepidopterous larvæ (Geometrids ?).
1 Small Tipulid.
1 *Bibio sp.*
3 Muscids.
300 *Aphis gossypii.*
A large quantity of buds ? and small pieces of leaves, probably derived from the larvæ eaten.

5–2–09. 4 *Tanymecus sp.*
2 *Myllocerus blandus.*
5–2–09. 4 *Myllocerus ? sp. ?*
3 Other coleopterous elytra.
17–4–09. 4 Geometrid larvæ.
6–4–08. 12 Small *Coleoptera* (Aphodiids ?).
7 Small Geometrid larvæ.
8–3–09. 9 Ephemerids.
1 Dipteron.

Summary.—Of 366 insects taken by 11 birds, 7 are beneficial, 329 injurious and 30 neutral.

410. *Phylloscopus fuscatus.*—Dusky Willow-warbler.

Stomachs examined—

8–3–09. Coleopterous remains.
Some vegetable matter.
12–3–09. 1 *Chilomenes sexmaculata.*
2 Geometrid larvæ.
Other insect-remains unidentifiable.
10–4–09. 2 Lepidopterous larvæ.
Other remains of insects unidentifiable.
4–10–08. 4 Geometrid larvæ.
2 Pyralid larvæ.
31–10–08. 7 Weevils.
1 Small Coprid.

A few Ficus seeds.
1 Shot.
20–11–07. 1 *Myllocerus sp.*
Some pieces of leaf.
A few Ficus seeds.
1–12–07. 2 *Myllocerus sp.*
4 few Ficus and weed seeds.

Summary.—Of 22 insects taken by 7 birds, 1 is beneficial, 20 injurious and 1 neutral. One bird took a beneficial insect and 6 injurious and 1 neutral. Four contained some vegetable matter, and in 3 of these Ficus seeds were in greater proportion than other vegetable matter.

417. *Phylloscopus superciliosus.*—Crowned Willow-warbler. Insects on trees. B. N. H. S. J., X, 610.

13–2–08. 2 Blattids.
1 *Phidole malinsi.*
1 *Tanymecus sp.*
Various coleopterous remains.
1 Spider.

Summary.—One injurious, and 3 neutral insects taken.

Acanthopneuste.—Willow-warblers and *Cryptolopha.*—Fly-catcher-warblers feed on insects on leaves. F. I., I, 423.

421. *Acanthopneuste nitidus.*—Green Willow-warbler.

9–12–07. 3 Small Hydrophilids.
Broken remains of small *Coleoptera.*
2 Small Spiders.

Hunting insects on cluster beans.

Summary.—Three neutral insects taken.

422. *A. viridanus.*—Greenish Willow-warbler.

21–12–07. 21 Ants legs.
3 Small Coleoptera.
Other remains of *Coleoptera* unidentifiable.
12–1–08. 1 *Tanymecus sp.*
Other remains of *Coleoptera* unidentifiable.

Summary.—One bird took neutral insects, the other one injurious insect.

458. *Suya crinigera.*—Brown Hill-warbler. Small insects and larvæ on the ground. Jerd. B. I., II, 183.

464. *Prinia socialis.*—Ashy Wren-warbler. Feed in the same way as *O. longicauda* (Sykes). Jerd. B. I., II, 171. That is, various

insects, chiefly ants and cicadellæ, and various small larvæ off buds and leaves, and not unfrequently seeking them on the ground.

465. *Prinia sylvatica.*—Jungle Wren-warbler.

8-2-09. 1 *Acantholepis frauenfeldi var. bipartita.*
1 Coleopterous grub.
Some buds and vegetable matter.

466. *Prinia inornata.* Indian Wren-warbler. Insects on bushes, etc. Jerd. B. I., II, 179. True friend of the husbandman, since it feeds exclusively on insects. Dewar, B. P., 220.

Sylviidæ.

That the smaller warblers, those especially of the genus *Phylloscopus*, may be regarded as beneficial is correct. There are but few exceptions to their general beneficial feeding qualities, and in India at present nothing is said against them. Those few species about which we have some definite knowledge are all neutral or beneficial, one, at any rate, *P. tristis*, being known to take the Cotton Aphis freely, and these insects (Aphides) will, in all probability, be found to form a portion of the food of every species. Some English species are at times undoubted pests of garden fruits, but this is in most cases counterbalanced by the numbers of insects consumed. In India their fruit-eating propensities would certainly not tell against them in the plains, most species being only cold weather migrants, but it is quite possible that some may be found to do local damage to fruits in the hills. We have no records of this at present.

LANIIDÆ.

Shrikes.

Malaconinæ.—The retiring members of this subfamily are commonly seen hopping or climbing about thick undergrowth in search of insects and their larvæ, or hunting for worms and spiders on the ground.

Pachycephalinæ.—The majority of the members hop actively about leafy trees, or search the ground for insects, their larvæ and berries.

Laniinæ. (Shrikes Proper).—The food, which may be taken on the wing, or procured upon the ground, consists of small mammals and birds, insects, snakes, frogs, or even crabs and fruit, the creatures not devoured at once being impaled on thorns or spiky leaves.

Prionipinæ. (Wood Shrikes).—They frequent trees and bushes, and eat molluscs and fruit, but live chiefly on insects captured on the branches, or on the ground, if not by darting into the air from a perch. E. B. C. N. H., 533-535.

Laniidæ.—The habit of keeping a larder is probably restricted to the larger species, and these only impale their victim when there is still something left on it left over, after they have eaten so much that for the time being they cannot possibly stow away any more. They feed on large grasshoppers, small lizards and birds and on field mice, but the usual food appears to be small insects. The young seem to be fed chiefly on large green caterpillars. Dewar B. P., 163-7.

They live chiefly on insects, impaling them on thorns before eating them. Bom. Gaz., Vol. XII, p. 34.

These birds live almost entirely on insects; the true shrikes occasionally seizing a small bird or mammal. Some descend to the ground to seize their prey, a few catch insects entirely on the wing, and others again merely search branches and leaves for their food. F. I., I, 455. Insects, small mammals and birds. Jerd. B. I., I, 986.

Lanius.—Capture insects on the ground, returning to their perch to devour them. Some species have the habit of impaling their prey on a thorn, and then tearing them to pieces. F. I., I, 457.

469. *Lanius lahtora.*—Indian Grey Shrike. It has the usual habits of the tribe, sitting on the top of some low tree, on the watch for a mole cricket, a locust, or some young or sickly bird to come near. Mr. Phillip states he has seen it capture small birds. Jerd. B. I., I, 401. $\frac{3}{4}$-grown squirrel. B. N. H. S. U., 12, 572.

473. *Lanius vittatus.*—Bay-backed Shrike. Young seem to be fed chiefly on large green caterpillars. Dewar B. P., 167.

475. *Lanius nigriceps.*—Black-headed Shrike. Grasshoppers and other insects on the ground. Jerd. B. I., 1, 404. Mole crickets B. N. H. S. J., 10, 610.

476. *Lanius erythronotus.*—Rufous-backed Shrike. Small caged birds (amadavit). Dewar B. P., 165.

Stomach examined—

13-5-07. 1. *Trithemis pallidinervis.*
1. *Myllocerus sp.*

Summary.—One injurious and one beneficial insect taken.

477. *Lanius tephronotus.* Grey-backed Shrike. Easily caught by an insect bait. Jerd. B. I., 1, 404. Mole crickets. B. N. H. S. J., X, 610.

481. *Lanius cristatus.*—Brown Shrike. White-ants. B. N. H. S. J., X, 303.

Stomachs examined—*

11-3-09.	8 *Chrotogonus sp.*
	12 Ephemerids.
	1 Small Coprid.
	1 *Myllocerus discolor.*
	1 *Plecoptera reflexa.*
28-6-08.	5 Coleopterous elytra.
	1 Moth's wing.
	1 Spider.
9-10-08.	1 *Myllocerus discolor.*
	3 *Tanymecus indicus.*
	1 Pyralid's wing.
	1 Caterpillar.
26-10-07.	11 *Œcophylla smaragdina.*
	1 Cicada.
	2 *Caloclytus annularis.*
10-12-07.	11 *Cremastogaster subnuda.*
	3 *Myllocerus discolor.*
	1 Small Weevil.
	12 Small *Coleoptera* (elytra).
7-12-07.	15 *Œcophylla smaragdina.*
	3 *Opatrum sp.*
12-12-08.	4 *Cremastogaster subnuda.*
	13 *Opatrum depressum.*

Summary.—Of 111 insects taken by 7 birds, 0 are beneficial, 37 injurious and 74 neutral. No birds took beneficial insects, 6

* The records stand under *L. cristatus* in Mr. Mason's Manuscript, but appear to belong to No. 488, *Tephrodornis pondicerianus.* (See page 19.)—T. B. F.

took neutral and 6 injurious: 1 took a spider. This species feeds mostly on the ground.

484. *Hemipus picatus.*—Black-backed Pied Shrike. Now and then insects in the air. Jerd. B. I., I, 413.

Malaconinæ.—Wood-shrikes. On insects and leaves and branches. Jerd. B. I. G., 408.

Tephrodornis.—Arboreal, never catch insects on the wing. F. I., 1, 473.

486. *Tephrodornis pelvicus.*—Nepal Wood-shrike. (Hodgson.) Grylli, also mantids, crickets, grubs and caterpillars. Jerd. B. I., I, 409.

487. *Tephrodornis sylvicola.*—Malabar Wood-shrike. Insects on trees. Jerd. B. I., I, 411.

488. *Tephrodornis pondicerianus.*—Common Wood-shrike.* Chiefly *Coleoptera* and *Orthoptera.* Jerd. B. I., I, 411.

Pericrocotus.—Are arboreal; insects on branches, only occasionally in the air or on the ground. F. I., I, 478. In flocks searching for insects. Bengal Gaz., Monghyr, 23.

495. *P. brevirostris.*—Short-billed Minivet. *Coleoptera* the chief food. Jerd. B. I., I, 421.

500. *P. peregrinus.*—Small Minivet. Small cicadæ, beetles, larvæ, etc. Jerd. B. I., 424.

Stomachs examined—

8–3–09.	3 Small Geometrid larvæ.
	1 *Tanymecus sp.*
	1 Small Cerambycid.
18–4–07.	1 *Tanymecus sp.*
	2 Small caterpillars.
	Some buds.
4–10–08.	Buds only.
14–10–08.	4 Weevils.
	5 Small caterpillars.
	1 *Caloclytus annularis.*

Summary.—18 injurious insects were taken by 4 birds. 2 of these birds took vegetable matter.

*See note against No. 481, *Lanius cristatus*, on preceding page.—T. B. F.

Campophaginæ.—Entirely insectivorous, caterpillars, etc. Jerd. B. I., I, 414.

Campophaga.—Arboreal.

505. *C. melanoschista.*—Dark-grey Cuckoo-shrike.—Chiefly caterpillars, also on other soft insects, as well as bugs and beetles, but never berries as Hodgson says it frequently eats. Jerd. B. I., I, 416.

508. *C. sykesi.*—Black-headed Cuckoo-shrike. Caterpillars and other soft insects. Jerd. B. I., I, 415.

Graucalus.—Insect-food obtained among foliage; arboreal, occasionally feeding on the ground.

510. *Graucalus macii.*—Large Cuckoo-shrike. Insects, chiefly caterpillars, mantids, locusts and other soft insects, but it also eats fruit, especially the fruit of the banyan. Jerd. B. I., I, 417. Insects and fruit on trees. Bom. Gaz., Cutch, Vol. X, p. 70.

Stomachs examined—

26–2–09.	11	Weevils [*Astycus* and *Myllocerus spp.*]
	1	*Homœocerus inornatus.*
	1	*Nezara viridula.*
	2	Geometrid caterpillars.
29–4–07.	1	*Gryllodes melanocephalus.*
	1	*Gryllotalpa africana.*
	6	Weevils sp.
	3	Hemiptera sp. ?
5–6–08.	1	*Gryllotalpa africana.*
	15	*Myllocerus sp.*
	2	*Nezara viridula.*
	3	*Cydnus nigritus.*
	1	*Cydnus sp.*

Summary.—3 birds took 48 insects, 45 of which are injurious: 1 bird took 3 neutral insects.

Artaminæ catch their food entirely on the wing. F. I., I, 498. A. S. B., LXIX, 115 (fuscus).

513. *Artamus leucogaster.*—White-rumped Swallow Shrike. Grasshoppers and other insects kicked up from grass. B. N. H. S. J., 17, 157. Insects on wing and turned up by the plough. B. N. H. S. J., 12, 395.

The *Laniinæ* or Shrikes are in all probability beneficial. We have few stomach records, and references to the food of the various species of this family are few also. They certainly appear beneficial from what we know of them at present. About half of the Indian species occur in the plains.

The *Artaminæ* or Swallow Shrikes of which there are only two species in India are regarded as one of the most useful groups in Australia. The Australian species occurs in the Andamans.

ORIOLIDÆ.

Orioles.

Orioles feed upon both fruit and insects, and so cannot be regarded as unmixed blessings to the agriculturist. Dewar B. P., 136.

Their food is fruit and soft insects, such as caterpillars. Jerd. B. I., II, 106. Orioles frequent forests—confining themselves to trees on the fruit of which they subsist together with insects found on the leaves. In habits strictly arboreal, never descending to the ground. F. I., I, 500.

To say that orioles never descend to the ground is not strictly applicable to our two common Indian species. They may often be seen to fly down on to low shrubs such as Oleander, and will often go to the ground, in all probability to pick up some insect they have shaken off the bush. I have on several occasions seen insects taken on the ground, and sometimes even on a road.

518. *Oriolus kundoo.*—The Indian Oriole. It feeds chiefly on fruit, especially on the fruits of the banyan and pakur, on mulberries, etc., and also occasionally on caterpillars and other soft-bodied insects. Jerd. B. I., II, 208.

Stomachs examined—

7–1–08.	1 Small Carabid.
	1 *Lygæus hospes.*
	1 Nematode worm.
	Ficus fruit.
8–2–07.	4 *Dysdercus cingulatus.*
	3 *Lygæus hospes.*

Stomachs examined—contd.

	2 *Lygæus sp.*
	Ficus fruit.
8–2–07.	Ficus fruit.
20–2–07.	2 *Dysdercus cingulatus.*
	Ficus fruit.
13–3–07.	2 *Weevils.*
	1 *Dysdercus cingulatus.*
	1 *Nezara viridula?*
	2 Hemipterous scutella.
20–3–07.	3 *Myllocerus sp.*
	Ficus fruit.
11–4–09.	1 *Camponotus compressus.*
	3 *Myllocerus discolor.*
	Ficus fruit.
15–4–07.	3 *Dysdercus cingulatus.*
	2 Geometrid ? larvæ.
20–5–07.	4 Larvæ. (*Ocinara varians?*)
	Ficus fruit.
16–5–08.	1 Large weevil.
	4 *Myllocerus sp.*
	1 Hemipterous scutellum.
	Ficus fruit.
13–6–08.	6 *Dysdercus cingulatus.*
	2 Spiders.
	Ficus buds and fruits.
7–9–08.	4 *Myllocerus maculosus.*
	1 Hemipterous scutellum.
	Ficus fruit and two buds.
12–10–07.	Ficus fruit.

Summary.—Of 52 insects taken by 13 birds, 1 is beneficial, 40 injurious and 11 neutral. 11 birds took insects, 2 having eaten insects only. 1 took spiders. The vegetable-food consists only of Ficus fruit, and this forms the greater bulk of the food taken. Two birds had eaten this fruit only.

This bird is a migrant, though a few remain during the cold weather. It is very common during the hot weather and the rains. It feeds principally on Ficus fruits, but also largely on caterpillars and bugs (*Hemiptera*) amongst which, *Dysdercus cingulatus*—the Red Cotton Bug—frequently occurs; this insect is taken off trees, seldom if ever off the cotton plant. This Oriole occasionally comes to the ground to feed, and while there has been seen to take the following insects,—From a grassy "band" which it fed to its young, a grub of *Anomala varians* (*sp. ?*), a fairly large Carabid on a

road, and from grass at the side of a road a Pyralid moth and here also it attempted to catch a noctuid (*Chloridea obsoleta*) which, however, got away; and a beetle (possibly a Tenebrionid) on a road. The young are fed principally on caterpillars and Ficus fruit, and to a less extent on moths, bugs and earthworms. No damage appears to be done to orchard fruits. It feeds, however, extensively on wild fruits, especially on Ficus and on mulberries.

521. *Oriolus melanocephalus.*—It feeds chiefly on fruit, especially on the figs of the banyan and other Fici; it is said also to eat blossoms and buds. Jerd. B. I, II, 111. Almost entirely on fruit. Bom. Gazette, Cutch, Vol. X, p. 76.

Stomachs examined—

9-1-08.	3 *Myllocerus discolor.*
	1 Spider.
22-1-08.	7 *Dysdercus cingulatus.*
	2 *Lygæus hospes.*
	1 Noctuid moth.
2-2-09.	1 *Odynerus punctum.*
	1 *Lawana conspersa.*
	Ficus fruit.
3-2-07.	1 *Lygæus hospes.*
	3 *Myllocerus sp.*
	1 *Dysdercus cingulatus.*
	Ficus fruit.
12-2-08.	1 *Polistes hebræus.*
	2 Spiders.
	Ficus fruit.
14-2-07.	Ficus fruit.
17-2-08.	8 *Dysdercus cingulatus.*
	2 *Myllocerus discolor.*
	2 *Myllocerus blandus.*
	Small Geometrid larva.
10-3-07.	1 *Dysdercus cingulatus.*
	2 *Lygæus sp.*
	1 *Nezara viridula?*
	Ficus fruit.
19-3-07.	5 Geometrid larvæ.
	Ficus fruit.
21-4-07.	5 *Œcophylla smaragdina.*
	1 *Caradrina pecten?*
	Ficus fruit.
21-4-07.	2 Small larvæ.
	Ficus fruit.
30-4-07.	5 *Opatrum sp.*
	2 *Myllocerus discolor.*
	3 Small weevils.

Stomachs examined—contd.

4–5–08.	3 *Dysdercus cingulatus.*
	2 *Nezara viridula.*
	1 Hemipterous scutellum.
	1 Noctuid moth.
4–5–07.	3 *Myllocerus maculosus.*
	Ficus fruit.
4–5–07.	1 *Rhynchium sp.*
	3 *Myllocerus discolor.*
	1 Lepidopterous larva ?
	Ficus fruit.
20–5–07.	Ficus fruit.
20–5–07.	Ficus fruit.
7–9–08.	1 *Polistes hebræus.*
	1 *Myllocerus sp.*
	Ficus fruit.
30–9–07.	1 Noctuid (wings).
	1 *Nezara viridula.*
	3 Hemiptera [heads].
	Trace of *Ficus* fruit.
10–10–08.	1 *Astycus lateralis.*
	1 *Myllocerus maculosus.*
	Ficus fruit.
1–11–07.	Ficus fruit.
1–11–07.	3 *Myllocerus sp.*
	2 *Astycus lateralis.*
	3 Weevils.
	2 Larvæ (*Lepidoptera ?*).
10–11–07.	Ficus fruit.

Summary.—Of 95 insects taken by 23 birds, 4 are beneficial, 73 injurious and 18 neutral. 5 had eaten insects only. 4 took beneficial insects, 17 injurious and 7 neutral. 2 birds took spiders: Ficus appears to be the only fruit taken. 17 birds had eaten this, 5 containing nothing else.

The food and feeding habits of the Black-headed Oriole are practically identical with those of the Indian Oriole. It is, however, a resident throughout the year. I have seen it apparently feeding on the ground twice, but could not see what it may have been feeding on.

522. *Oriolus trailli.*—Caterpillars only. Jerd. B. I., II, 112.

Three species of Orioles occur in the plains, the two mentioned above being the only common species. Both these common species are beneficial. In some districts these birds are apparently eaten

by natives. They need protection on the same lines as is suggested under *Coracias indica* (No. 1022).

The Orioles are all probably beneficial.

EULABETIDÆ.

Grackles or Talking Mynahs.

Entirely frugivorous. Jerd. B. I., II, 337. Strictly arboreal, feeding entirely on fruit. F. I., I, 509.

523. *Eulabes religiosa.*—Southern Grackle. Fruits and berries of various kinds. Jerd. B. I., II, 238.

524. *E. intermedia.*—Indian Grackle. Large numbers snared and exported to Calcutta until quite recently, but the trade is now forbidden. B. N. H. S. J., XVII, 158.

527. *Calornis chalybeius.*—Glossy Calornis. Feeding chiefly upon figs, and honey out of flowers. B. N. H. J. S., XVII, 158. Ficus fruits. B. N. H. S. J., XII, 397.

Probably of no importance. Most are frugivorous and haunt hill tracts.

STURNIDÆ.

Mynahs and Rosy Pastors.—"Gram and other leguminous rabi crops are much damaged by *illi*, the larvæ of *Chloridea obsoleta*, a green caterpillar, that eats out the pods. It is especially liable to spread in cloudy weather and its great foes are Mynahs and Rosy Pastors; when there are trees round a field for these creatures to perch on, they will soon make an end of the caterpillars. A field attacked by *illi* often seems perfectly alive with starlings of all kinds hopping up and down in pursuit of their prey which they eat without ceasing all day long." Balaghat Dist. Gaz., 1907.

The more terrestrial forms walk and run excellently, often stop ping suddenly to probe the soil for worms or larvæ, which, with insects generally, and molluscs provide the chief sustenance. A large amount of fruit is also consumed, including berries and seeds; Frogs, and as some say, callow nestlings are devoured; *Pastor, Dilo-*

phus and *Acridotheres* destroy locusts ; *Eulabes* and its allies prefer vegetable-food. E. B. C. N. H., 561. The starlings are gregarious, feeding alike on grain, fruit and insects. Jerd. B. I., II, 320. They frequent trees, but the major portion of their food is obtained on the ground. F. I., I, 517.

528. *Pastor roseus*.—Rosy Pastor.

The following account is taken from Indian Museum Notes :—

"In view of the great effect which the bird undoubtedly has in keeping the locusts in check, it has been suggested in several quarters that it might be a good thing to take measures to have it protected by legislation. It seems very doubtful, however, to what extent any such measure would be useful in the end, in view of the great injury the bird is said to do to grain crops in India. Jerdon (B I., Vol. II, p. 333) says ' It usually makes its appearance in the Deccan and Carnatic about November, associating in vast flocks, and committing great devastations on the grain fields, more especially on those of the cholum or jowaree (*Andropogon sorghum*) whence its familiar name in the south.' Mr. Elliott says ' Is very voracious and injurious to the crops of white jowaree.' He also describes how the coolies are stationed in the fields with the slings, etc., to scare the birds whose depredations are committed in the mornings and evenings, and adds 'The Tilliars are so active that if they be able to alight on the stalks for an instant, they can pick out several grains. They prefer the half ripe Jowaree whilst the farinaceous matter is still soft and milky. When they can no longer get grain, they feed on various grass and other seeds, flower buds, fruit, and also on insects, seeking them on the ground, but they are rarely seen with cattle in India. The Telugu name is derived from the name of a plant whose fruit they are particularly fond of. Mr. Blythe remarks that 'They visit the neighbourhood of Calcutta only at the end of the cool season, when flocks of them are not unfrequently observed upon the arboreal cotton tree then in bloom.' Burgess states that he has seen them busily feeding on the flowers of the leafless caper, a shrub very common in the Deccan on the banks of the large rivers. Dr. Adams says that 'it is very

abundant in the Punjab committing great havoc on the grain there.' In the North-West of India and Afghanistan they devour large quantities of mulberries in the spring. They at times, however, feed much on insects, and are called the 'locust-bird' in Persia, according to Chesney....Burgess also states that in 1850 towards the end of August he saw a large flock feeding on insects in the open. They do not breed in India.''

"It has been noticed also that when the locusts enter a grain field, the Tilliars do not pursue them into it, but station themselves all round its borders and kill the locusts as they issue forth.''

The following reports are also from the same source. Locusts in parts of Sind in 1889-1890 were exterminated by the Jowari bird. Mr. Omanney mentions that these birds were great enemies of the locust (Khandesh 1883). Similar reports were made by Dr. F. Chand, Gujranwalla, 1891; by the Director of Land Records and Agriculture, Punjab, the Bannu District, 1891, by the Acting Deputy Commissioner of Thar and Parkar, Sind, 1891. Major H. P. Leigh says it appears in Kohat with Kabul sparrows, when the mulberries are ripe; it preys on the locust, but if in small numbers, will not face a large swarm. It appears to kill them for amusement rather than for food, leaving them in a very mutilated condition. The Deputy Commissioner, Dera Ismail Khan, wrote in 1891 that the Rosy Pastor eats locusts greedily, and though large swarms of these insects appeared, but little damage was done to the crops as the birds drove them off. Mr. E. C. Cotes also notes this habit in "the locust invasion of 1889-1892.'' (I. M. N., III, 79.)

Jerdon also notes (B. I., II, 334) this bird is more a grain and fruit eater perhaps than any other members of the family.

Stebbing (M. F. Z.), with regard to the distribution of seeds by means of birds voiding undigested seeds, says: "A good example of this action of birds can be seen in the Changa Manga plantation, where the Rosy Pastor, which assembles in enormous flocks to feed on the fruits of the mulberry trees in the plantation, has distributed the seed, and consequently planted up considerable areas in this

manner. On the other hand, this bird is a serious pest in fields of grain."

The Rosy Pastor is a great enemy to the larvæ of *Chloridea obsoleta* on gram and other leguminous crops.—Balaghat Dist. Gaz., 1907.

At certain times of the year large flocks of Tilliars (the Rosy Pastor) visit the district, and wage war against the locusts, if there are any about.—Punjab Gaz., Jhelum, 25.

Rosy Pastor—" The hereditary enemy of the locust." Punjab Gaz., Shapur, 21.

Pastor roseus stays as long as there is any grain or fruit to be had.—Bom. Gaz., Cutch, Vol. 5.

In large flocks in every grain field.—Bom. Gaz., XII, 36.

The damage done to grain crops, especially jowari, is always greater if there are any trees about on which the birds can perch in the neighbourhood. If there are no trees the birds can be driven off the fields much more effectively, and the damage therefore to cropped areas is not nearly so great. Planting up of babul trees is therefore unpopular in some localities.—Bom. Gaz., Sholapur, XX, 514.

Notoriously destructive to grain crops, especially millet.—Imp. Gaz. I, 243.

The " golia " (? Rosy Pastor) is a bird which appears in October ; it damages the crops, but as a set-off against this it is a special enemy of the locusts.—Punjab Gaz., Hissar, 20.

March and April, insects in the flowers of *Bombax malabaricum*.—Bom. Gaz., Ahmedabad, IV, 82.

Stomachs examined—

14-4-08.	1	*Myllocerus maculosus.*
		Ficus fruit.
14-4-08.		
14-4-08.		
14-4-08.		*Ficus* fruit (*F. religiosa*).
15-4-08.		
15-4-08.		

Summary.—1 injurious insect taken ; examined 6 birds. All had eaten ***Ficus*** fruit.

I have only seen this bird twice in Behar in the last three years and the six specimens then obtained proved to have fed almost entirely on *Ficus* fruit. In September 1908 I noticed this species to be very generally distributed from Delhi to Rohri (*viâ* Bhatinda) in cultivated areas. It appeared to be in small flocks, only about 50 birds at the most in a flock, and so in this respect much resembling the Bank Mynah (*Acridotheres ginginianus*) and to feed all day long in the crops of jowari. Most of the bird-scaring is done from "machans" erected in the middle of the crop, the birds being scared off the crop by slings, shouting, beating tins, etc. Almost every year when one hears of locust swarms these birds together with crows are reported to accompany the swarms and to act as a considerable check on the numbers of the locusts. They not only destroy large numbers of locusts, but also do much good, since, by worrying the insects, they drive them on from place to place, so checking the damage to some extent and preventing the crops of one locality from total destruction. The damage is lessened and spread over a larger area. The only record we have of this bird attacking other insect-pests was in conection with a spasmodic and an unique attack on various crops by a species of cricket, possibly *Liogryllus bimaculatus*. This attack was completely checked by this bird.

It is more than probable that this species, when noticed on the jowari crops and apparently feeding entirely on the grain, also takes some insects. In very few cases will it be found that more or less omnivorous birds have their diet consisting entirely of one form of food at any time.

[It is extremely uncertain how far one can say that this bird really does any good with locust-hoppers. They come in flocks and feed during the day when the hoppers are fairly active, with the result that the swarms break up and scatter, making the work of destruction more difficult. I have never seen or heard of a case where the birds were numerous enough to really effect the numbers of the hoppers materially; the flocks of birds are very impressive, but each bird eats only a few hoppers and they are not restricted wholly to them, but appear to require other food at the same time.

In the case of winged locusts, each locust is broken up and only a part is eaten but only a small number are killed.

On the other hand, a bird that eats *Chloridea obsoleta* on gram is doing very material good and this observation requires confirmation. There is a need for accurate observation and stomach examination of this bird in some locality in Northern India throughout the year, to provide data on which to estimate the real value of this bird.—[H. M. L.]

Sturnus.—Starlings feed chiefly on the ground on insects and worms, but they are fond of fruit and berries which they pick off trees.

529. *Sturnus humii.*—Himalayan Starling. Grain and insects among cattle.—Jerd. B. I., II, 312.

532. *Sturnus menzbieri.*—Common Indian Starling. Grain and insects among cattle. Works grass lands like a Mynah. Jerd. B. I., II, 322.

Sturnia more arboreal than true starlings, feeding on insects and the nectar contained in flowers, but they also feed on the ground a good deal. F. I., I, 525.

537. *Sturnia blythii.*—Blyth's Mynah. Entirely arboreal. Insects and larvæ, small shells (Bulimi) and occasionally on fruit.—Jerd. B. I., II, 332.

538. *Sturnia malabarica.*—Grey-headed Mynah. Strictly arboreal. I do not remember ever having seen a Grey-headed Mynah on the ground.—B. N. H. S. J., XVI, 488. Feeds chiefly on trees, on various fruits and seeds, also on insects.—Jerd. B. I., II, 331.

Stomachs examined—

15–2–09.	16	*Myllocerus* sp.
	1	*Tanymecus* sp.
		These insects were obtained from flowers of *Bombax malabaricum*.
		A little *Ficus* fruit.
2–4–08.	1	Ephemerid.
	6	? Carabids ?
	1	*Myllocerus maculosus.*
	1	Pyralid ?
	9, 10	Vegetable matter: consisting of *Ficus* and grass seeds.

Stomachs examined—contd.

15–5–08.	1 Small beetle.
	Ficus fruit.
24–5–08.	1 Gryllid.
	14 *Myllocerus* sp.
	Ficus fruit.
22–6–08.	1 *Monomma brunneum*.
	Ficus fruit.
20–7–08.	6 Coleopterous elytra.
	1 Elaterid.
	9 Geometrid caterpillars.
	3 *Ocinara varians* larvæ.
	There was a moth's cocoon in this bird's beak when shot.
23–8–08.	1 *Astycus lateralis*.
	1 Hemipteron sp.?
	Ficus fruit.

Summary.—Of 64 insects taken by 7 birds, 6 are beneficial, 47 injurious, and 11 neutral. 1 bird took beneficial insects, 5 injurious, and 5 neutral. 6 contained Ficus fruit, one of these also containing other vegetable matter.

This bird chiefly haunts *Bombax malabaricum* when in flower and also Sissoo. It occasionally comes to the ground to feed oninsects, though it is, for the most part, frugivorous. It is far more numerous at Pusa during the rains than at other times. It breeds in holes in trees, and feeds the young mostly if not entirely on lepidopterous larvæ and grubs. I have seen Melolonthid, Geometrid and Noctuid larvæ fed to the young.

540. *Sturnia andamanensis.*—Andaman Mynah. Leaf-rolling caterpillars on bamboo, general insect feeder. B. N. H. S. J., XII, 397. These caterpillars are, in all probability, the larvæ of the common Pyralid, *Pyrausta coclesalis*.

541. *Sturnia erythropygia.*—Nicobar Mynah. Berries and fruits: occasionally insects on wing. B. N. H. S. J., XII, 398.

544. *Temenuchus pagodarum.*—Black-headed Mynah. Brahminy Mynahs do not seem to be particular what they eat. Numbers will usually be seen in the neighbourhood of the conservancy trenches. B. N. H. S. J., XVI, 488. At Madras it feeds chiefly on the ground among cattle, in company with *A. tristis*, picking up grasshoppers and other insects. It also feeds on trees, on various fruits, berries

and flower buds and occasionally insects. Adam says that in Kashmir it feeds on seeds and buds of pines. When the silk-cotton tree comes into flower, it is always to be found feeding on the insects that harbour in the flowers. Jerd. B. I. II, 230.

I once saw one of these Mynahs pick up a large caterpillar in some grass by the side of a road.

547. *Graculipica burmanica.*—Jerdon's Mynah. When the big cotton trees (*Bombax malabaricum*) are in flower, these birds may be seen and heard in immense numbers. B. N. H. S. J., XVII, 189.

Acridotheres.—The true Mynahs prefer insect-food, but will also eat grain, and indeed are almost as omnivorous as the crows. Jerd. B. I., II, 324.

549. *A. tristis.*—Common Mynah. Fragments of cooked rice round houses : others attend flocks of cattle picking up grasshoppers disturbed by their feet, while some hunt for grain or fruit.....Introduced to Mauritius from India to destroy grasshoppers and is perfectly naturalised there. Jerd. B. I., II, 325.

Some kinds of birds, such as Sparrows, Mynahs and Wagtails eat weevils (*Calandra oryzæ*) I. M. N., I, 28.

This objectionable bird is doing its best to oust *Sturnia andamanensis* from the Andamans. It was introduced in 1873. B. N. H. S. J., XVII, 159.

They have also been introduced to Hawaii and New Zealand and in some localities are said to be a great nuisance, as they drive away pigeons and fowls and are said to destroy nests and eggs of domestic birds.

The "gurral" (*? A. tristis*) is another bird which has a well-developed taste for standing crops. Punjab Gaz., Hissar, 20.

Gulgul is a local name in the Central Provinces for *A. tristis* and therefore gurral may possibly refer to the same species. Grain, fruit and insects. Bombay Gaz., Ahmedabad, IV, 82.

Stomachs examined—

1–1–08.	1 *Chrotogonus* sp.
	3 Paddy grains.
	Ficus fruit.
5–2–08.	5 Oat grains.
	7 Maize grains.
	Ficus fruit.
5–2–08.	1 Ephemerid.
	1 *Myllocerus discolor.*
	1 Hemipterous scutellum.
	7 Maize grains.
	Ficus religiosus fruit.
6–2–09.	7 *Œcophylla smaragdina.*
	1 *Camponotus compressus.*
	Maize grains.
	Oat husks and grass blades.
10–2–08.	1 *Opatrum* sp.
	5 Oats.
	Ficus sp. fruit.
	Bombax malabaricum flower.
15–2–08.	8 Maize grains.
	Ficus fruit.
15–2–08.	*Ficus* fruit.
28–2–08.	6 *Œcophylla smaragdina.*
	3 *Camponotus compressus.*
	1 *Phidole malinsi.*
	1 *Myllocerus* sp.
	1 *Bibio* sp.
	1 *Bagrada picta.*
	Grass seeds.
	Ficus religiosus fruit.
28–2–08.	1 *Camponotus compressu*
	1 *Anomala varians.*
	1 Green Geometrid larva.
2–3–08.	*Ficus religiosus* fruit.
14–5–08.	1 *Gryllotalpa africana.*
	1 *Apis indica.*
	12 Tenebrionids.
	1 Spider.
	Ficus fruit.
14–5–08.	6 *Chrotogonus* sp.
	1 *Tryxalis* sp.
	5 *Brachytrypes achatinus.*
	Ficus fruit.
29–5–08.	5 *Chrotogonus* sp.
	3 *Opatrum* sp.
22–6–08.	1 *Trox indicus* (sp. ?)
	1 Carabid sp.
	2 Weevils probably *Myllocerus* sp.
	Ficus fruit.
25–6–08.	2 *Chrotogonus* sp.
	1 *Oxya* sp. ?.

Stomachs examined—contd.

	1 *Tanymecus* sp.
	3 *Myllocerus* sp.
	7 Maize grains.
5–7–08.	7 *Liogryllus bimaculatus?*
	Ficus fruit.
8–7–08.	8 *Brachytrypes achatinus.*
	3 *Myllocerus maculosus.*
	2 Earth-worms.
24–8–08.	1 Small grasshopper.
	1 Ephemerid.
	1 *Sphex lobatus.*
	1 *Scolia quadri-pustulata.*
	1 *Myllocerus* sp.
	1 Spider.
	Ficus fruit.
	A few small seeds.
14–8–08. } 5–11–08. }	Eleven birds contained maize grains and *Ficus* fruit only.
9–10–08.	1 Coprid sp. ?
	Ficus fruit.
	Vegetable matter.
12–11–08.	1 *Dorylus* sp.
	2 *Astycus lateralis.*
	1 Small beetle.
	2 *Myllocerus maculosus.*
	2 *Carabids.*
	Vegetable matter.
9–12–08.	*Ficus* fruit.
9–12–08.	*Ficus* fruit.
9–12–08.	*Ficus* fruit.
9–12–08.	3 *Camponotus compressus.*
	1 *Gymnopleurus miliaris.*
	Ficus fruit.

Summary.—Of 110 insects taken by 35 birds, 58 are injurious, 5 beneficial and 47 neutral. 45 birds took beneficial insects, 13 injurious and 12 neutral. One bird took worms, and 2 took spiders. Two birds took insects only.

Twenty-nine birds took *Ficus* fruit, this food forming the greater proportion of the food found in the stomachs examined; 5 took oats, 16 maize, and 1 paddy grains. One took the flower of *Bombax malabaricum* and 5 contained other vegetable-matter. Eighteen contained vegetable-matter only.

The Common Mynah has the usual habits of the starlings, working grass lands, and freshly ploughed fields for insects. It is not a general fruit eater, though a large proportion of its food consists of

the fruits of the various common Indian Fici. This is apparently the only class of fruit it habitually eats. It is said to do no harm to orchard fruits, and only visits such places for insects which it can pick up off the ground. I remember in one instance taking a strawberry out of the stomach of a Mynah. When any Ficus is ripe, all birds found in the locality, if examined, are almost certain to contain some of this fruit. Of other vegetable-materials which form part of the Mynah's food, the large succulent flowers of the Silk-cotton Tree (*Bombax malabaricum*) are largely eaten in February and March, grass and weed seeds and more rarely leaves are taken throughout the year. In a few cases I have noted that white fleshy axils had been eaten. Of cereals, maize is the particular favourite and some considerable damage is done to this crop from mid June until the harvest is finished, some preference being undoubtedly shown to the seeds while still soft and unripe. Eleven birds examined during this period have contained nothing but this food together with a little Ficus fruit. Wheat is occasionally taken, and oats to an even less extent. Sorghum was said in December 1906 to have been damaged considerably by Common Mynahs at Pusa, but I fancy this was not due to *A. tristis*, but to *A. ginginianus* and *S. contra*.

With regard to its insect-food the Mynah is not at all particular. Grasshoppers, crickets, and the larvæ of both *Coleoptera* and *Lepidoptera* are perhaps taken more than any other forms. Grasshoppers are mostly taken when the birds accompany cattle feeding on grass lands, the insects being disturbed by the cattle. Crickets are usually taken in irrigated land when they are drowned out, or flooded out, of their holes. Irrigated lands, too, afford this bird a good hunting ground for worms, which are eagerly sought for at all times, but notably during the rains. Mynahs eat a considerable number of moths of all descriptions. I have seen *Plusia orichalcia* and *Ancylolomia chrysographella* and various other Noctuids and Pyralids taken on the wing. These birds are sometimes present during attacks of swarming caterpillars and with *Sturnopastor contra* were said to have considerably checked these

insects (*Prodenia littoralis*, *Caradrina exigua*, and *Spodoptera mauritia*) in the Central Provinces in 1908. I have seen it also pursuing *Papilio pammon* and *P. demoleus*, and also the common wasp *Polistes hebræus*. At the commencement of the rains when the flying termites emerge, the food consists largely of these insects, taken both on the wing and at the emergence exits; in the latter case both the winged and wingless forms of the termites being taken. With its fig diet numbers of the fig parasite are eaten.

When working grass lands and when following the plough great numbers of cutworms and some Melolonthid larvæ are eaten, as often as not at such times the food being composed almost entirely of the former pests.

During the attack of *Ophiusa melicerte* on castor at Pusa in 1909 the Mynah was present, though in no great numbers, and was feeding to a certain extent on these caterpillars, helping with other birds to check the numbers of the insects. The first larva of *Ophiusa coronata* was found at Pusa (H. M. Lefroy) owing to the fact that a Mynah was seen trying to take it from its food plant (*Quisqualis*). The Common Mynah and also Starlings are said to feed on beetle grubs in "Senji," but I doubt their ability to do so as they do not usually feed on boring insects.

I have seldom noticed Mynahs eating beetles, the only ones so far noted being various species of Tenebrionids especially *Opatrum* spp., and *Bolboceras calanus* (on one occasion only). An apparent dislike is at times shown towards various species of Carabids (*Chlænius* sp., etc.) I have often seen these birds feeding on roads where there were plenty of these beetles and yet they were not touched.

The food of the young consists mostly of larvæ of various sorts; cutworms of several species—*Agrotis ypsilon*, *A. flammatra ?* *A. spinifera*, etc.—varied with a certain proportion of Melolonthid larvæ, grasshoppers, crickets and soft fruits such as Ficus. I noticed on one occasion, when a young bird was being fed in the field, that its food then consisted almost entirely of the common cricket *Liogryllus bimaculatus*.

During the rains a very favourite hunting ground with the Mynah is banks, grassy or otherwise, in which various species of crickets have their burrows. They may be seen hunting there all day waiting for a cricket to come out, but they appear to catch more in the evenings when the crickets come out in greater numbers. King-crows capture many of these insects at the same place and not infrequently rob the Mynahs. The two species of crickets taken in at such times are *Brachytrypes achatinus* and to a less extent *Gryllotalpa africana ;* the latter coming out of their burrows later in the evenings. Mynahs join with crows and king-crows in mobbing snakes. "I know of few things more amusing than to witness a pair of Mynahs give a snake a bit of their minds as they waltz along beside it in a most daring manner." Dewar B. P., 97.

551. *Acridotheres ginginianus.*—Bank Mynah. Usual habits of the group, feeding much with cattle and partaking alike of insects, grain and fruit. Jerd. B. I., 99, II, 327. When indigo is cut, this bird occurs commonly in the fields for insects ; also among cattle picking insects off their legs. B. N. H. S. J., XVIII, 630.

Stomachs examined—

24–8–08.	1	*Cyrtacanthacris ranacea.*
	2	*Chrotogonus* sp.
	2	*Camponotus compressus.*
	1	*Penthecus* sp. (Pusa No. 2442).
	1	*Myllocerus* sp.
	1	*Sphæridium 5-maculatum.*
		Chlænius.
	1	*Chlænius* sp. (Pusa No. 1172).
	1	Histerid.
	3	Carabids (spp.)
	23	Diptera.
30–6–09.	3	Small coleopterous elytra.
	7	*Ophiusa melicerte larvæ.*
	1	*Nezara viridula.*
30–6–09.	1	Coleopterous elytron (Tenebrionid ?).
	92	*Ophiusa melicerte* larvæ.
30–6–09.	2	*Camponotus compressus.*
	1	*Opatrum* sp.
	5	*Ophiusa melicerte* larvæ.
30–6–09.	14	*Ophiusa melicerte* larvæ.
30–6–09.	12	*Ophiusa melicerte* larvæ.
30–6–09.	8	*Ophiusa melicerte* larvæ.
30–6–09.	7	*Ophiusa melicerte* larvæ.

Summary.—Of 106 insects taken by 8 birds, 4 are beneficial, 67 injurious, and 35 neutral. One bird took beneficial insects, 8 injurious, 4 neutral.

This bird appears only to hunt in flocks, much more so than is the habit with the Common Mynah (*A. tristis*). During the last two years I have only seen it at Pusa on one or two occasions; on the first it was feeding among cattle on various insects, among which—from the stomach then obtained—it appears it was largely feeding on flies. The second occasion it appeared in fairly large numbers during a very bad attack of the common castor pest, *Ophiusa melicerte*. The seven birds then obtained showed that it was feeding almost entirely on this caterpillar, the greatest number in one stomach being 14. The flock of birds in the 2 acres of castor numbered at least two hundred, and estimating the number of caterpillars eaten per bird per day as 50—a very low estimate—we see that these birds destroyed at least 10,000 caterpillars in one day. This bird appears to be locally known as the "Tilliar," and therefore in any local reports it is as well to note that in parts of Behar at any rate this name does not apply to the Rosy Pastor.

Information with regard to this bird's food is at present very limited, but from what is on record it would appear that this Mynah is the most beneficial of the whole group. It is possible, however, that damage reported to crops, such as that I have already mentioned under *A. tristis* (damage to sorghum at Pusa in 1906), may be due to this species.

This sudden appearance at Pusa, where the bird is but seldom observed, is an excellent instance of local migration for food, and it would be interesting to know by what means the bird detected the presence of the caterpillars. It may also be interesting to note that in the attack abovementioned *A. tristis* was only present in very small numbers, and certainly destroyed very few caterpillars in comparison with *A. ginginianus*. These birds disappeared as soon as there were no more caterpillars to feed on, a few remaining in the fields accompanying cattle, which is the commonest method

adopted by this bird for obtaining food. It is in appearance very much like *A. tristis* and may easily be confounded with this bird at a distance, by anyone who has not closely studied the habits and appearance of both species.

552. *Aethiopsar fuscus.*—The Jungle Mynah. Seeds and fruit of various kinds, and it is very often seen clinging to the tall stem of the large Lobelia so common on the Neilgherries, feeding on the small insects (bugs chiefly) that infest the capsules of that plant.—Jerd. B. I., II, 328.

On the Gauhati-Shillong road, this Mynah may be found at every halting stage, where it feeds on the remains of cattle food and the spilt rice and gram.—B. N. H. S. J., XVII, 795.

Grain, fruit and insects.—Bom. Gaz., Ahmedabad, IV, 82.

554. *Aethiopsar albicinctus.*—Collared Mynah. Feeding on the ground, or on the insects and nectar in the huge flowers of the cotton tree.—F. I., I, 542.

555. *Sturnopastor contra.*—Pied Mynah. Grain, fruits and insects among cattle.—Jerd. B. I., II, 324.

Stomachs examined—

8–2–09.	7 *Opatrum depressum.*
	Ficus fruit.
12–2–08.	1 Melolonthid larva.
	1 Coprid.
	Ficus fruit.
22–2–08.	*Ficus* fruit.
1–3–09.	*Ficus* fruit.
1–3–08.	5 *Opatrum* sp.
12–3–08.	1 *Onthophagus* sp.
	1 Caterpillar.
	Ficus fruit.
16–3–09.	*Ficus* fruit.
16–4–08.	*Ficus* fruit.
21–4–08.	*Ficus* fruit.
30–4–08.	5 *Chrotogonus* sp.
	2 Cutworms.
	Ficus fruit.
2–5–08.	1 *Onthophagus* sp.
	Ficus fruit.
13–5–08.	2 *Tryxalis* sp.
	1 *Chrotogonus* sp.
	2 Cutworms.

Stomachs examined—contd.

	Ficus fruit.
21–6–08.	3 *Camponotus compressus.*
	1 Small cricket.
	Vegetable-matter.
22–6–08.	3 Ants (legs only).
	2 *Opatrum* (*depressum ?*).
	1 Carabid.
	1 Small caterpillar.
	Ficus fruit.
27–11–08.	Grass and weed leaves and seeds.

Summary.—Of 39 insects taken by 14 birds, 1 is beneficial, 25 injurious, and 13 neutral. One bird took a beneficial insect, 6 neutral and 7 injurious insects. One bird took insects only, 12 birds took *Ficus* fruit which forms a greater percentage of this bird's food than that of the Common Mynah, and 2 took other vegetable-matter. Six took vegetable-matter only.

The Pied Mynah has much the same feeding habits as the Common Mynah. On the whole, however, it is decidedly more vegetarian. Some of this species may nearly always be seen in company with *A. tristis* working grass and cultivated fields, and they are seldom seen by themselves in flocks of more than 20 birds or so. When any Ficus fruit is ripe or a cereal crop, such as maize, the birds flock to these and at such times will be found to feed on little else. They seem even more partial to Ficus fruit than the Common Mynah. Some considerable damage is done at times to the various common cereal crops—maize, sorghum and paddy especially. Its insect-food is much the same as that of the Common Mynah, consisting as far as one can see in the field very largely of grasshoppers, small moths, etc. I have not noticed it to take flying Termites.

The *Sturnidæ.*—Starlings and Mynahs are perhaps the most widely distributed and generally known of all our Indian birds, and it is to this group in particular that special attention is required in order to determine whether they are of sufficient economic importance to require protection and encouragement. Information with regard to the food of the commoner species is at present absolutely inadequate for any definite statement to be made, and can

only be given when we have a far larger series of stomach records, and also reliable information from field observations from the main localities frequented by these birds.

With regard to the Rosy Pastor, little can be said beyond what has already been noted. It must, however, be borne in mind that as soon as the locusts migrate from the hills for their breeding grounds these birds attack them ; they therefore attack the first swarms and reduce their numbers considerably before egg-laying commences, the good done at that time therefore being of far more value than if the insects were only attacked after egg-laying had commenced or finished. The Rosy Pastor does not breed in India ; if it did so, it would probably have the habits of the Common Mynahs in feeding its young on caterpillars to a great extent and also on other insects, and we could then put it down as beneficial in India generally, in spite of the vast damage done to ripening jowari, etc. As it is, it seems a doubtful question as to whether the harm done outweighs the good.

Sturnopastor and *Acridotheres* have already been discussed. They at times appear to do some considerable damage to maize, sorghum and other grains, but they are also very general insect-feeders, being especially fond of grasshoppers, and it would seem that they are beneficial, and that the custom of putting out boxes for the birds to breed in, as practised in some parts, is to be commended. Even when these birds are found in cereal crops and feeding on the grain, a fair proportion of this grain is picked up off the ground and the stomachs of birds obtained under such conditions nearly always contain a number of insects. The food of the young too consists almost entirely of insects, and these mostly injurious ones. They are, as a rule, encouraged in fruit orchards.

Sturnus contains one species which migrates to the plains in the cold weather—*S. menzbieri*, and which works grass lands like a typical starling. I have not seen it on ploughed or cultivated lands. Other genera are composed mostly of uncommon or hill species which can have but little reference to agriculture, and we can safely assume that as long as these birds are not greatly on the

increase they are beneficial. We have no definite records of any damage being done to fruit by this family.

Of crows and starlings Mr. W. L. Sclater (I. M. N., Vol. II, p. 121), says :—" With regard to those of mixed diet...it would certainly be unadvisable to protect them, since they do much greater harm in devouring fruit and grain than they do good in destroying insects : such is specially the case with crows and starlings."

We know practically nothing of value of the food of the starlings in India. Of the mynahs more but not enough is yet known. As with all omnivorous birds, before we can think of protection we must know the beneficial importance of the species in question at the present time, and also, a fact which is equally if not even more important, what food that species will take if by any chance its present normal food supply fails.

Muscicapidæ.

The Flycatchers feed on insects which they either catch on the wing starting from a perch to which they return several times, or by running with the aid of their wings along the limbs of trees.—F. I, II, 2.

All the species of true flycatchers catch their prey on the wing or by running along branches, occasionally going to the ground. Insects their chief food.—Jerd. B I., I, 443. Termites.—Jerd. B. I, I, 292.

Little but insects which are caught habitually on the wing.—E. B. C. N. H, 508.

562. *Siphia albicilla.*—Eastern Red-breasted Flycatcher. Appears to find sufficient insects to feed on in the pine trees.—B. N. H. S. J., XVII, 957.

Stomachs examined—

31-1-08.	1 Small dragon fly.
	2 *Myllocerus discolor.*
	9 *Tanymecus* sp.
8-2-09.	1 *Œcophylla smaragdina.*
	1 *Camponotus compressus.*
	4 *Opatrum* sp. (*depressum ?*).
	1 *Mesomorpha villiger.*

Stomachs examined—contd.

	1	Lepidopterous larva.
	1	Dipteron (head).
8–2–09.	2	*Mesomorpha villiger.*
	4	Aphodiids.
3–3–07.	2	*Myrmecocystus setipes.*
	4	*Tanymecus? elytra.*
3–3–07.	3	*Camponotus compressus.*
	2	*Mesomorpha villiger.*
	1	*Opatrum* sp.
	1	Pyralid wing.
12–3–09.	1	*Hypsa ficus?*
10–3–08.	6	Elytra of *Tanymecus? Myllocerus.*
	6	Aphodiids. (Pusa No. 2106).
	1	Pyralid wing.
	1	Dipteron.
11–4–09.	3	*Opatrum* sp.
	1	*Scleron orientale.*
	4	*Myllocerus discolor.*
	1	*Thea cincta.*
12–4–07.	4	*Myrmecocystus legs?* (4 insects).
	1	*Opatrum* sp.
	1	*Coccinella 7-punctata.*
	5	*Rhyssemus germanus.*
	3	*Tanymecus* sp.
11–10–08.	1	*Camponotus compressus.*
	12	*Myllocerus* sp.
	1	Hemipterous scutellum.
11–11–07.		Weevil remains only (7 or 8 specimens).
30–11–07.	3	*Tanymecus* sp.
	1	*Myllocerus* sp.
	1	Noctuid larva.
	2	Pyralid wings.
	1	*Cydnus nigritus.*

Summary.— Of 108 insects recorded in the stomachs of 12 birds, 3 belong to the beneficial group, 64 to the injurious, and 41 to the neutral. Three birds took beneficial insects and 11 injurious, and 8 neutral.

The food of this flycatcher consists almost entirely of beetles, but a very fair proportion of ants is eaten. It may be seen day after day in the same place pursuing insects on the wing and especially various kinds of small moths. I have seen it take several species of Pyralids, including *Ancylolomia chrysographella*, *Pyrausta coclesalis*, and one or two Noctuids including *Caradrina pecten*, and *Plusia* sp. Once it was seen to take an *Opatrum* sp. from the ground.

Conclusions.—The stomach records are perhaps too few for any definite conclusion, but from these together with the field notes and from what is known in a general way about the food of Flycatchers, we may certainly class this bird as *beneficial.*

580 *Stoparola sordida.*—Dusky-blue Flycatcher. Mulberries.—B. N. H. S. J., 303 ?

581. *Stoparola albicaudata.*—Nilghiri Blue Flycatcher. Old and young birds eating fruit.—B. N. H. S. J., XVI, 153.

591. *Ochromela nigrirufa.*—Black-and-Orange Flycatcher. Young receives an insect from its mother.—B. N. H. S. J., XVI, 134.

Niltava said to eat berries.—F. I., II, 39.

Niltava and other forms eat berries and the like in late summer. —E. B. C. N. H., 509.

592. *Culicicapa ceylonensis.*—Grey-headed Flycatcher.

Stomachs examined—

2–3–09.	1 Aphodiid.
	Remains of other small *Coleoptera.*
	7 Small flies.
	1 Hemipteron (head).

Summary.—Of 9 insects taken all are neutral.

594. *Niltava sundara.*—Rufous-bellied Niltava. Chiefly insects from ground, and even leaves and branches. Hodgson says it sometimes eats berries and seeds in winter.—Jerd. B. I., I, 474.

598. *Terpsiphone paradisi.*—Indian Paradise Flycatcher. It sometimes enters verandahs and hawks insects from trellis-work (Madras).—B. N. H. S. J., XVI, 489.

Feeds chiefly on small flies and cicadellæ ; in captivity on flies and mosquitoes ; flies attracted by the odour of shrimps.—Jerd. B. I., I, 477. Flies and spiders on window frame (Muscitræa = ? Terpsiphone).—Bom. Gaz. Thana, Vol. XIV.

Stomachs examined—

2–7–08.	3 *Myllocerus ?* sp. ?
	2 *Coleoptera* (elytra).
	A mass of finely broken insects, possibly Psyllids or Jassids.
4–7–08.	1 Coleopterous elytron.
	4 Flies.
12–8–08.	6 Flies.

Summary.—Of 16 insects taken, 3 are injurious, 13 neutral.

Rhipidura pick flies off cattle.—E. B. C. N. H., 508.

604. *Rhipidura albifrontata.*—White-browed Fantail Flycatcher. Its chief food is mosquitoes and other small dipterous insects, also the small cicadellæ (? Jassidæ) that are so abundant on every tree in India. Pursuing flies from the back of a cow.—Jerd. B. I., II, 453. Insects on cattle, eye flies, parasites.—B. N. H. S. J., X, 302.

605. *Rhipidura albicollis.*—White-throated Fantail Flycatcher. Small flies and mosquitoes.—Jerd. B. I., 452.

Flycatchers are not numerous in species on the plains, about one in four of the recorded Indian species occurring, and some of these but rarely. They are in all probability beneficial. They are as a general rule insectivorous, though some species take fruits, berries and seeds occasionally.

Turdidæ.

Saxicolinæ and Ruticillinæ feed chiefly on the ground, and are more insectivorous than thrushes. Redstarts and chats will take insects on the wing.—E. B. C. N. H, 517.

Saxicolinæ.—Chats. Habits muscicapine: the insect-food captured by sallies from a fixed perch. The Chats feed entirely on insects, which they capture generally on the ground from a fixed perch, such as the summit of stones, a stalk of grass, or a branch of a bush and then return at once to their post of observation.—F. I., II, 57.

608. *Pratincola caprata.*—Common Pied Bush-chat. I saw this bird at Kasauli catching small grass moths (Pyralids and Geometrids).

629. *Cercomela fusca.*—Brown Rock-chat. Feeds on the ground on various coleopterous insects, ants, etc.—Jerd. B. I., II, 134.

Ruticillinæ.—Forktails, redstarts, blue-throats, nightingales, robins, grandala, calene, and shamas. Habits terrestrial: the

insect-food captured on the ground. Feed principally on the ground, they are almost entirely insectivorous.—F. I., II, 81.

Henicurus.—Found in mountain streams, feeding on insects found at the edge of water.—F. I., II, 82.

630. *Henicurus maculatus.*—Western Spotted Forktail. Various insects and larvæ.—Jerd. B. I., II, 213.

637. *Microcichla scouleri.*—Little Forktail. Various water-insects, chiefly on the larvæ of various Neuroptera that frequent the wet rocks and edges of rapids.—Jerd. B. I., II, 215.

638. *Chimarrhornis leucocephalus.*—White-capped Redstart. Insects at edge of water.—Jerd. B. I., II, 144.

Ruticilla.—Feed on the ground largely, but also capture insects on the wing.—F. I., II, 98.

639. *Ruticilla frontalis.*—Blue-fronted Redstart. Insects on ground.—Jerd. B. I., II, 141.

644. *Ruticilla rufiventris.*—Indian Redstart. On ground on various insects.—Jerd. B. I., II, 138.

Stomachs examined—

5–2–09.	3	*Camponotus compressus.*
	2	*Mesomorpha villiger.*
	5	Small caterpillars.
21–2–07.		*Camponotus compressus.*
	7	*Phidole malinsi.*
	1	Hemipterous scutellum.
	3	Small caterpillars.
2–3–09.	3	*Camponotus compressus.*
	4	*Mylloccrus discolor.*
	5	*Hydrophilids.*
	1	Geometrid larva.
3–4–07.	1	Small Elaterid.
	3	Elaterid grubs ?
	1	Carabid.
	2	*Mylloccrus* sp.
	1	Geometrid caterpillar.
	1	Moth's wing.
	2	*Hemiptera* (scutella).
	2	*Cydnus* sp.
9–12–07.	1	*Camponotus compressus.*
	12	*Phidole malinsi.*
	2	*Cremastogaster subnuda.*
	1	*Onthophagus* sp.

Stomachs examined—contd.

1 *Gymnopleurus miliaris.*
3 Small caterpillars.
1 Hemipterous scutellum.

Summary.—Of 70 insects taken by 5 birds, 1 is beneficial, 22 injurious and 47 neutral. One bird took beneficial insects, 5 neutral and 5 injurious.

This bird seems to haunt rahar, mustard and indigo more than any other crops. It, however, occurs in waste lands and jungle.

Rhyacornis.—Inhabit mountain streams.—F. I., II, 98.

646. *Rhyacornis fuliginosus.*—Plumbeous Redstart. Aquatic insects and larvæ at the edge of water. Insects on a wall.—Jerd. B. I., II, 143.

647. *Cyanecula suecica.*—Indian Blue-throat. Insects on ground.—Jerd. B. I., II, 153; and N. H. S. J., XI, 80.

Stomachs examined—

1-2-08.	3 *Opatrum depressum.*
	1 *Scleron orientale.*
	4 Small beetles.
	1 *Myllocerus* sp.
15-2-09.	5 *Mesomorpha villiger.*
	1 *Pachnephorus impressus.*
	2 Caterpillars.
12-12-07.	4 *Myrmecocystus setipes.*
	5 *Myllocerus discolor.*
	3 Hydrophilids.
	1 Small Dytiscid.
	1 Dipteron.
	1 Caterpillar.

Summary.—Of 32 insects taken by 3 birds, 13 are injurious and 19 neutral. One bird took beneficial insects, 3 injurious and 3 neutral.

Practically all the food is obtained on the ground, and it is very fond of hunting about water-channels for insects and worms; the latter are not often eaten, or at any rate do not form so large a proportion of the food as insects. I have only once seen this bird on a bush, and it was then apparently hunting for insects.

650. *Calliope camtschatkensis.*—Common Ruby-throat. Various insects on the ground, especially in covered plantation of betel vine.—Jerd. B. I., II, 150.

Ianthia. Insectivorous, sometimes pulpy berries.—Jerd. B. I., II, 146.

658. *Grandala cœlicolor.*—Hodgson's Grandala. Insects and gravel: habits of a starling.—Jerd. B. I., II, 120. Insects on ground.—F. I., II, 111.

659. *Notodela leucura.*—White-tailed Blue Robin. (Hodgson) "feeds equally on pulpy berries:" various insects.—Jerd. B. I., II, 119.

661. *Thamnobia cambaiensis.*—Brown-backed Indian Robin. Insects on wing.—Jerd. B. I., II, 122.

662. *Thamnobia fulicata.*—Black-backed Indian Robin. Insects on wing.—Jerd. B. I., II, 121.

663. *Copsychus saularis.*—Magpie-robin. Insects of various kinds: small grasshoppers, beetles, worms, etc. Hodgson asserts that in winter they like unripe vetches, etc., but this is quite opposed to the usual habits of the group.—Jerd. B. I., II, 115.

Stomachs examined—

2-1-08.	2	Small grasshoppers.
	1	*Opatrum* sp.
		Some vegetable matter.
5-2-09.	7	*Camponotus compressus.*
	3	*Myrmecocystus setipes.*
	1	*Myllocerus discolor.*
	1	*Tanymecus* sp.
	1	Weevil ? sp. ?
	12	*Mesomorpha villiger.*
12-2-07.	17	*Opatrum depressum.*
	1	*Myllocerus* sp.
20-2-08.	2	*Apis indica.*
	5	*Apis florea.*
	3	*Œcophylla smaragdina.*
	1	*Scleron orientale.*
	2	*Opatrum depressum.*
		Some weed seeds and leaves.
26-3-07.	1	*Gryllotalpa africana.*
	2	*Chrotogonus* sp.

Stomachs examined—contd.

	3 *Opatrum* sp.
	Some vegetable-matter.
4–5–07.	3 *Camponotus compressus.*
	5 *Opatrum* sp.
	2 *Mesomorpha villiger.*
23–6–07.	3 *Chrotogonus* sp.
	5 *Opatrum* sp.
	1 *Onthophagus* sp.
	1 Earthworm.
10–7–08.	1 *Tiphia* sp.
	2 *Anomala* larvæ. (*A. varians*).
	1 *Astycus lateralis.*
	1 *Myllocerus maculosus.*
	1 Bud.
9–10–08.	3 Melonthid larvæ.
	3 *Opatrum* sp.
	1 Small weevil.
	4 Cutworms. (*A. ypsilon?*)
	1 Spider.
12–10–08.	4 *Camponotus compressus.*
	2 *Onthophagus spinifer.*
	Other insect remains.
10–11–08.	3 *Œcophylla smaragdina.*
	2 *Polyrachis simplex.*
	1 *Cataulacus taprobanæ.*
	4 *Camponotus compressus.*
	7 *Opatrum* sp.
	5 *Myllocerus discolor.*
	1 Weevil.
1–12–07.	12 *Opatrum* sp.
	1 Cutworm.

Summary.—Of 142 insects taken by 12 birds, 7 are beneficial, 50 injurious, and 85 neutral. One bird took beneficial insects, 11 took injurious and 11 neutral. One bird took a spider and 1 a worm, both of which are beneficial, 4 contained vegetable-matter.

Notes.—Nests of young have been watched on several occasions: the young are fed mostly on grubs and caterpillars, many of which are cutworms. They are occasionally fed with *Gryllodes melanocephalus* and *Gryllotalpa africana.* A Blue Jay [*Coracias indica*] has often been seen trying to rob a nest containing eggs or young; in one case attacks on three successive days were repelled, the Jay then giving up the attempt. A Mynah was once seen to steal a mole cricket from a Magpie Robin.

Conclusion.—The beneficial insects taken are of minor importance, and I believe it probable that the bees were not taken alive. The injurious insects are of far more economic importance than the beneficial—and we may therefore conclude that this bird is probably beneficial.

664. *Cittocincla macrura.*—Shama. Grasshoppers, etc. In captivity on "chenna" and yolk of hard boiled eggs, and will thrive well if occasionally given a few maggots or insects. It also eats raw meat.—Jerd. B. I., II, 117.

TURDINÆ.

Black-birds, ouzels, thrushes, field-fares and red-wings. Habits terrestrial and arboreal, both insectivorous and frugivorous. They differ chiefly from the Saxicolinæ and the Ruticillinæ in being less dependent on insects for their food—berries forming a considerable portion of their diet during the cold weather. Thrushes feed a good deal on the ground.—F. I., II, 120.

Thrushes feed chiefly on the ground, where they hop about scratching and searching for worms, molluscs and insects—fruit is also eaten.—E. B. C. N. H., 517.

(Merulidæ) thrushes—insects, especially the softer kinds, grubs, snails and also fruit, rarely hard seeds.—Jerd. B. I., I, 485.

(Merulinæ) insects, molluscs, earthworms; with several, especially in winter, also fruits and berries—Jerd. B. I., 510.

667. *Merula simillima.*—Nilgiri Black-bird. Snails, glow-worms, caterpillars and other soft insects, but a good deal on fruit, especially on the hill gooseberry (*Physalis peruviana*).—Jerd. B. I., I, 525.

671. *Merula nigripileus.*—Black-capped Black-bird. Like other black-birds, feeds much on the ground on snails, soft insects and occasionally on fruit. At Nellore I found that it had lived almost entirely on the pretty *Helix bistrialis.*—Jerd. B. I., I, 523.

676. *Merula boulboul.*—Grey-winged Ouzel. In captivity on earthworms.—B. N. H. S. J., XIX, 150.

677. *Merula atrigularis.*—Black-throated Ouzel. Insects and berries.—Jerd. B. I., I, 529. Wild cherries, A. S. B., LXIX, 161.

683. *Geocichla wardi.*—Pied Ground-thrush. Various insects.—Jerd. B. I., I, 521.

685. *G. cyanonotus.*—White-throated Ground-thrush. Chiefly insects, such as ants, cockroaches and beetles, but not unfrequently also stony fruit.—Jerd. B. I., I, 517.

686. *G. citrina.*—Orange-headed Ground-thrush. On insects on ground among leaves.—Jerd. B. I., I, 518. Insects on ground.—B. N. H. S. J., XI, 81.

Stomachs examined—

2–2–09.	1	*Œcophylla smaragdina.*
	1	*Phidole malinsi.*
	3	*Opatrum elongatum.*
	6	*Opatrum* sp.
	4	*Opatrum* sp.
	1	*Myllocerus* sp.
	1	*Himatismus* sp.
	1	Noctuid larva.
	3	Hemiptera (heads).
	1	Small worm.
14–2–09.	6	*Camponotus compressus.*
	24	*Opatrum depressum.*
	5	*Mesomorpha villiger.*
	3	*Myllocerus* sp.
	4	Hemipterous scutella.

Summary.—Of 63 insects taken by 2 birds, 29 are injurious and 34 neutral. Both birds took neutral and injurious insects, and one bird took a worm.

690. *Petrophila erythrogastra.* Chestnut-bellied Rock-thrush. Chiefly insects.—Jerd. B. I., I, 143.

Hawking and catching winged insects.—B. N. H. S. J., X, 151.

691. *P. cinclorhyncha.*—Blue-headed Rock-thrush. Appears to feed on various fruits and berries.—Jerd. B. I., I, 516.

692. *P. solitaria?*—Eastern Blue Rock-thrush. Bread, insects, centipedes, grain, small fruits, snails, slugs, worms, lizards.—B. N. H. S. J., XI, 161 and 336.

693. *P. cyanus.*—Western Blue Rock-thrush. Chiefly on *Coleoptera* and ants.—Jerd. B. I., I, 513.

698. *Oreocincla dauma.*—Small-billed Mountain Thrush. Its food does not differ from that of the thrushes. I found fruit and seeds in those I examined.—Jerd. B. I., I, 534.

Stomachs examined—

2-2-09. 1 Myrmeleo larva.
6 *Prionocerus bicolor.*
3 *Opatrum depressum.*
1 Cut-worm.
1 Geometrid larva.

Summary.—Of 12 insects taken, 1 is beneficial, 5 injurious and 6 neutral. Though feeding on the ground, this bird does not apparently take 'ber' (*Zizyphus jujuba*) fruit, when fallen.

701. *O. mollissima.*—Plain-backed Mountain Thrush. Insects and berries.—Jerd. B. I., I, 533.

Cochoa feed on the ground and on trees.—F. I., II, 158.

706. *C. purpurea.*—Purple Thrush. I have taken from their stomachs several kinds of stony berries, small univalve mollusca and sundry kinds of aquatic insects.—Jerd. B. I., II, 243.

Cinclinæ.—Dippers or Water Ouzels. Habits aquatic. They are admirably fitted for obtaining their food in the water.—F. I., II, 162.

They dive noiselessly in search of insects, their larvæ and pupæ, or molluscs; fish spawn has not been found in the stomach.—E. B. C. N. H.

709. *Cinclus asiaticus.*—Brown Dipper. Various water insects and larvæ, also shells when it can get them, and, it is said, ova of fishes.—Jerd. B. I., I, 50.

Accentorinæ.—Accentors. Habits terrestrial. They feed on insects and also it is said on small seeds.—F. I., II, 57 & 167.

Accentors feed much on the ground on various insects, worms and seeds.—Jerd. B. I., II, 284-285.

Saxicolinæ.—More than half the Indian species are found in the plains, many being migrants, visiting the plains in the cold weather. Their food appears to consist entirely of insects.

Ruticillinæ.—About half a dozen species are found in the plains, the Magpie Robin being the only resident. They are all almost entirely insectivorous, though at times the Magpie Robin undoubtedly takes vegetable-matter. It is also probable that several species take worms and spiders, especially the robins and blue- and ruby-throats.

Turdinæ.—Almost entirely confined to the hills, about ten species occurring sparingly in the plains during the cold weather. In addition to insects they live to some extent on fruit, and may at times be found to damage garden bush and other fruits. In other respects they are almost certainly beneficial.

Cinclinæ 'frequent mountain streams' and are too few in species and individuals to be of any account.

Accentorinæ.—Exclusively hill birds and are probably beneficial.

PLOCEIDÆ.

Weaver Birds and Munias.

The food generally procured upon the ground consists mainly of seeds, but it is varied by insects—occasionally taken on the wing—fruits and flowers; while the birds play havoc with rice and other crops, often clinging to the stems until they have eaten every grain from the head.—E. B. C. N. H., 578.

Ploceinæ.—Weaver birds feed largely on grain and seed.—F. I., II, 174. Weaver birds live almost exclusively on grain. 'Grain.'—Jerd. B. I., I, 292.

720. *Ploceus baya.*—Baya. Grain of all kinds, especially rice and various grass seeds; "The fig of the Banyan." Sykes.—Jerd. B. I., II, 345.

"Nests are a source of danger in the fire season in Assam. During a fire they catch light at base, the few threads by which they

are suspended quickly burn through, and the nest resembles a fire balloon, and may be blown away many hundred yards across cleared fire lines into areas which would otherwise be safe from infection. It is recommended that in such localities all weaver birds' nests should be cleared from trees on fire lines, and closely adjacent to such. Mr. Perree.''—S. M. F. Z. Grain, Bom. Gaz., Ahmedabad, IV, 83.

Stomachs examined—

13–10–09.	3 Birds, grass seeds only.
12–11–07.	Grass seeds only.
14–11–08.	3 Birds, grass seeds only.

721. *Ploceus megarhynchus.*—Eastern Baya. Considerable damage to grain, notably paddy.—B. N. H. S. J., XI, 81.

Viduinæ.—Munias. They feed on the ground or else cling to the heads of flowering grass or corn, and they consume large quantities of grain.—F. I., II, 181.

Munia feed much on rice as well as grass seeds.—Jerd. B. I., II, 353.

725. *Munia malacca.*—Black-headed Munia frequents dry grain and sugar-cane fields.—Jerd. B. I., II, 353. Grass seeds.—Bom. Gaz., Ahmedabad, IV, 83.

726. *Munia atricapilla.*—Chestnut-bellied Munia. Damages ripe paddy.—B. N. H. S. J., XI, 353. Locally known as rice sparrow.—B. N. H. S. J., XVII, 960.

727. *Uroloncha acuticauda.*—Hodgson's Munia. In very large flocks in the rice fields as the grain is ripening and must do a great deal of damage.—B. N. H. S. J., XVII, 960.

728. *Uroloncha striata.*—White-headed Munia. Vast flocks in paddy fields.—Jerd. B. I., II, 356.

730. *Uroloncha fumigata.*—Andaman White-backed Munia. Bamboo or grass seeds.—B. N. H. S. J., XVII, 160.

734. *Uroloncha malabarica.*—White-throated Munia.

5–2–09.	Small weed seeds and vegetable matter.
9–10–08.	Weed seeds, chiefly grass and vegetable matter.
9–10–08.	Grass seeds and other vegetable matter.
10–3–08.	" " " " " "

21–6–08.	Grass seeds and other vegetable matter.
21–6–08.	,, ,, ,, ,,
21–6–08.	1 Paddy grain.
	Grass seeds and other vegetable matter.
13–8–08.	,, ,, ,, ,,
13–8–08.	,, ,, ,, ,,
13–8–08.	,, ,, ,, ,,
8–9–08.	1 *Chrotogonus* sp.
	1 Batch of Blattid eggs.
	Several grass seeds.

Summary.—One injurious insect taken, and a batch of eggs of a Blattid [neutral insect]. All the 11 birds had taken weed seeds, and 1 took a paddy grain (which cannot have been taken from a standing crop).

735. *Uroloncha punctulata.*—Spotted Munia.

12–6–07.	2 Weevils (9 legs only).
	Small weed seeds.
28–7–08.	Grass seeds only.
28–7–08.	Grass seeds only.

Summary.—One bird took 2 injurious insects, all 3 had taken weed seeds.

A nest of this species was watched for some time, but being high up in a bamboo fork, nothing could be identified. It undoubtedly feeds the young to some extent on smallish caterpillars.

Ploceinæ or Weaver Birds, all occur in the plains, and are well known pests to grain. Nothing appears to be on record of what these feed on when grain is not obtainable.

Viduinæ or Munias. The Indian species all appear to be plains' birds. The common species do some considerable damage to grain, especially paddy, but a large percentage of their food in all probability consists of small weed seeds and sometimes of insects.

FRINGILLIDÆ.

Finches.

Fringillidæ is sub-divided into *Coccothraustinæ, Fringillinæ* and *Emberizinæ.*—The food consists mainly of seeds, but other fruits, buds, leaves, insects and their larvæ are also eaten, not to mention peas, crocus flowers and the like; crossbills and some other forms cleverly extract the seeds of fir cones.—E. B. C. N. H., 568.

The finches are normally graminivorous or frugivorous, but they also eat insects, and the young are fed entirely on these. They are, for the most part, gregarious and arboreal, but they descend to the ground freely to pick up food.—F. I., II, 194.

Finches for the most part feed on seeds.—Jerd. B. I., II, 341.

Coccothraustinæ.—Grosbeaks or haw-finches. The Indian grosbeaks live in forests and feed on stony fruits.—F. I., II, 196.

Frequent forests and live mostly on stony fruits.—Jerd. B. I., II, 384.

744. *Mycerobas melanoxanthus.*—Spotted-winged Grosbeak. Remains at Mussoorie as long as there are ripe cherry stones to crack: ripe stony fruits.—Jerd. B. I., II, 387.

Fringillinæ.—Cross-bills, finches, linnets, twites, siskins, bramblings, sparrows. Feed both on seeds and insects.—F. I., 202.

The finches are chiefly seed-eaters; the young of most are fed with vegetable-food, not with insects as is the case with the sparrows and buntings.—Jerd. B. I., II, 383.

Sparrows (*Passer*) feed chiefly on grain, but will also eat insects, and many feed their young chiefly on the latter food.—Jerd. B. I., II, 362.

Pyrrhula.—Bull-finches feed much on buds of trees, especially in winter.—Jerd. B. I., II, 389.

746. *Pyrrhula erythrocephala.*—Red-headed Bullfinch. (Hutton), feeds on ground as well as on berry-bearing bushes.—Jerd. B. I., II, 389.

Loxia.—The crossbills feed chiefly on seeds from the cones of various pine trees.—F. I., II, 208.

750. *Loxia himalayana.*—The Himalayan Crossbill. The Crossbill is stated to eat apples and other fruit.—Jerd. B. I., II, 393.

751. *Hæmatospiza sipahi.*—Scarlet Finch. Fruits and seeds of various kinds.—Jerd. B. I., II, 395.

753. *Pyrrhospiza punicea.*—Red-breasted Rose-finch. Searching for food at the camping grounds.—F. I., II, 212.

758. *Propasser rhodochrous.*—Pink-browed Rose-finch. Alight on the ground in search of seeds.—Jerd. B. I., II, 402.

761. *Carpodacus erythrinus.*—Common Rose-finch. Seeds of bamboos, and so much is this its habit that its Telegu name (yedra-pichike) signifies "bamboo sparrow." Various seeds and grain: also not unfrequently of flower buds and young leaves. Adams states that in Kashmir it feeds much on the seeds of a cultivated vetch.—Jerd. B. I., II, 399.

762. *Carpodacus severtzovi.*—Severtzoff's Rose-finch. Berries of sea buckthorn (*Hippophæ rhamnoides*) especially.—Jerd. B. I., II, 398.

764(*b*). *Rhodospiza obsoleta.*—Desert Finch. Sunflower seeds, etc., grass seeds.—B. N. H. S. J., XIII, 708.

767. *Carduelis caniceps.*—Himalayan Goldfinch. Feeds chiefly on the seeds of the thistle.—F. I., II, 226. Seeds of thistles.—B. N. H. S. J., XVI, 53.

771. *Metoponia pusilla.*—Gold-fronted Finch. Feeds on thistles.—Jerd. B. I., II, 411.

774. *Fringilla montifringilla.*—Brambling. On the ground both on seeds and insects, as well as on trees.—F. I., II, 334.

Sparrows (*Fringillinæ*) live chiefly on grain, but will also eat insects, and many feed their young chiefly on the latter food.—Jerd. B. I., 362. I, 292.

Sparrows do some considerable damage to paddy crops in Madras generally.

775. *Gymnorhis flavicollis.*—Yellow-throated Sparrow.

Stomachs examined—

3–2–07.		Some leaves, grass and weed seeds.
5–2–09.	7	*Myllocerus discolor.*
21–2–09.		Legs of small weevils.
		Some vegetable-matter.
		Some grit and sand.
	1	Small stone.
13–3–07.	1	*Myllocerus discolor.*
	1	*Tanymecus hispida.*
	1	Piece of *Ficus* fruit.
		Some grass and weed seeds.

Stomachs examined—contd.

12–4–07.	3 Shoots of ? bamboo.
	Some leaves, grass seeds and weed seeds.
20–5–08.	2 *Myllocerus* sp. ? (broken elytra).
	Some ants' ? legs.
	Weed seeds and vegetable-matter.
3–6–07.	1 *Onthophagus spinifer.*
	2 *Myllocerus discolor.*
	1 *Tanymecus* sp.
	Weed and grass seeds and leaves.
31–6–08.	Entirely vegetable, mostly consisting of small hard black seeds.
27–7–08.	1 Small Geometrid larva.
	Grass seeds, weed seeds, and some vegetable-matter.
4–10–08.	1 *Œcophylla smaragdina.*
	Small grass and weed seeds and some vegetable-matter.
15–10–07.	Entirely grass seeds.
11–11–07.	1 Oat grain.
	1 Maize grain.
	Ficus fruit.
	Grass, and some small weed seeds.

Summary.—Of 17 insects taken by 12 birds, 2 are neutral and 15 injurious. The remains of other injurious insects (weevils) and neutral insects (ants) were also noted. Seven birds only contained insects. Eleven birds contained vegetable-matter consisting of grass seeds, leaves and weed seeds. Two had eaten some *Ficus* fruit and one a maize and an oat grain.

776. *Passer domesticus.*—House Sparrow. *Passer domesticus* and the common striped squirrel (*Sciurus palmarum*) two of the greatest pests of most stations. I have frequently seen it chase and capture moths in a room.—Jerd. B. I. II, 363-4.

Some kinds of birds eat weevils (*C. oryzæ*) such as sparrows.—I. M. N. I, 28.

Ascend hills at times where there is cultivation, following the rice carts.—B. N. H. S. J., XV, 459.

Dewar says sparrow nestlings in the early stages are fed almost exclusively on caterpillars, grubs and insects. "It is the custom to speak of the sparrow as a curse to the husbandman. The bird is popularly supposed to live on grain, fruit, seedlings and buds—those of valuable plants by preference. There is no denying the fact that the sparrow does devour a certain amount of fruit and grain, but, so far from being a pest, I believe that the good it does by des-

troying noxious insects far outweighs the harm. Adult sparrows frequently feed on insects. I have watched them hawking flies in company with the swifts, and the skill displayed by the 'spadger' showed that his was no 'prentice' hand at the game. Sparrow nestlings are, in the early stages, fed almost exclusively on caterpillars, grubs and insects.'' There are usually five or six in a nest, and assuming that the hen sparrow feeds them 15 times an hour for 12 hours a day for 20 days bringing three caterpillars at each visit, the brood is responsible for the destruction of 10,000 insects, mostly caterpillars. There are two broods at least in the year, thus accounting for 20,000 insects fed to the young in the nest not inclusive of what the cock and hen eat, and what the cock brings to the nest. Tiny green grubs in a sausage-shaped sack, also caterpillars and on one occasion a mulberry were seen fed to the young. '' But it was not often that she gave them fruit; green caterpillars formed quite nine-tenths of what she brought in; the remainder was composed chiefly of grubs, with an occasional grasshopper or moth. As the young grew older, the proportion of insect-food given to them diminished until, when they were about 22 days old, their diet was made up principally of grain.''—Dewar B. P., 16-28.

Common House-Sparrow is only too common at all times and places. Punjab Gaz., Shahpur, 21.

Stomachs examined—

3-3-07.	1	Coleopterous elytron (*Tanymecus* sp. ?) Grass and weed seeds.
28-5-08.	2	*Coleoptera* (*Myllocerus* sp. ?, & an Aphodiid ?). Small weed and grass seeds.
30-5-07.		Small weed and grass seeds and apparently some buds. A few *Ficus* seeds.
21-6-08.		Small pieces of weeds, small seeds and broken vegetable matter.
9-10-08.		Weed and grass seeds, and some vegetable matter.
12-10-08.		Grass and weed seeds and leaves.
2-10-08.	6	Oats (obtained from stable). Small grass and weed seeds.
16-11-08.		Grass and weed seeds and leaves.

Summary.—Three insects only were taken from the stomachs of 8 birds; 2 are injurious and one neutral. One bird contained some oats taken from a stable, and each bird contained grass and weed seeds far in excess of any other food.

Notes.—This bird has been said to eat larvæ and imagines of the Potato Moth (*Phthorimæa operculella*) both in the field and in the store. It undoubtedly eats many insects. At Kasauli I saw it frequently pursuing and capturing moths. They appeared particularly fond of hunting trellis work on verandahs for insects especially moths, and I saw several *Ganophus coloris* taken and eaten (captured as they were at rest on the trellis or wall). Besides some small Pyralids, a Lycænid (*Ilerda sena*) and an *Agrotis* sp. were also seen captured at the same place. The first *Scardamia metallaria* recorded from Pusa I took from a house-sparrow. The grubs of the "Senji" weevil (*Hypera variabilis*) and also the larvæ of *Tarache notabilis* are both said to be eaten by the sparrow, a considerable check being kept on the latter by the bird.

It is interesting to note that though this sparrow appears to occur in numbers wherever there are Europeans, yet at Pusa we hardly ever see this bird, and therefore we have no stomach records of any importance.

This bird is generally regarded as a pest. I very much doubt this for India as a whole...In cultivated areas in the neighbourhood of towns the bird will almost certainly prove a pest, but where it occurs only in small numbers, which would be in country places away from towns, this bird is most probably beneficial. Considering, however, the fact that this species is an undoubted pest in some countries, its protection cannot at present be recommended in India.

777. *Passer pyrrhonotus.*—Rufous-backed Sparrow.
Appeared to feed on the seeds of grasses.—B. N. H. S. J., XIX, 260.

786. *Fringillauda nemoricola.*—Hodgson's Mountain Finch. Kernels and hard seeds digested by trituration with gravel. (Hodgson).—Jerd. B. I., II, 414.

Emberizinæ.—Buntings. Buntings frequent cornfields, waste lands and grassy tracts. They devour grain in large quantities, and also feed on seeds of all sorts.—F. I., II., 250.

The young are said to be fed chiefly on insects.—Jerd. B. I., II, 369.

790. *Emberiza fucata.*—Grey-headed Bunting. (Swinhoe) standing cornfields in China.—Jerd. B. I., II, 376.

796. *E. hortulana.* Ortolan Bunting. The true Ortolan. Watt.—D. E. P. I. 'O. 251.'

797. *Emberiza aureola.*—Yellow-breasted Bunting. (Swinhoe) ripening corn in China.—Jerd. B. I., II, 380.

798. *E. spodocephala.* Black-faced Bunting. Damage ripe paddy.—B. N. H. S. J., II, 83.

799. *E. melanocephala.*—Black-headed Bunting. Notorious for the ravages it commits in cornfields.—Imp. Gaz., I., 245.

Great devastation in cornfields.—F. I., II, 352.

Very destructive to crops of Jowari and other grains.—Jerd. B. I., II, 378.

A common winter visitant, joining with the Weaver-birds in plundering the grain fields.—Bom. Gaz., Vol. XX, 514 (Sholapur).

803. *Melophus melanicterus.*—Crested Bunting. Grasshoppers : also same to young.

Coccothraustinæ are entirely confined to the hills and feed apparently entirely on hard or stony fruits. They may possibly be found to make inroads on some orchard fruits, but are not recorded as doing so.

Fringillinæ.—Bull Finches, Cross-bills and Rose Finches may all be expected to do some damage to orchard fruits, though this is probably counterbalanced by the other forms of food taken. With the exception of the Common Rose Finch and the Desert Finch they are confined to the hills.

We have no definite proof that the Sparrows are pests in India. The few records available and references seem to point that they are beneficial. Seeing, however, what pests these birds are in other countries it appears that they certainly do not merit protection. Only 4 species are found in the plains.

Emberizinæ.—The Buntings, most of those that occur in the plains being winter migrants (2 species apparently are residents), do some considerable damage to grain. Little is on record otherwise, and as with the Fringillinæ the young are fed to a great extent on insects, mostly caterpillars. I noted this of the Yellow Ammer (*Emberizina citrinella*) in England and in all probability the Indian species have practically the same feeding habits. *Emberiza hortulana*, the true Ortolan of Europe, is but occasionally seen in India.

HIRUNDINIDÆ.

Swallows.

Hirundinidæ.—Martins and Swallows. The whole food consists of small insects caught on the wing.—F. I., II, 267. (Hirundines) exclusively on small insects: mosquitoes, midges, gnats. To feed young, insects are collected in a ball in the mouth.—B. N. H. S. J., III, 43.

Insects, which form the whole of their sustenance, are habitually taken on the wing.—E. B. C. N. H., 524.

809. *Cotile sinensis.*—Indian Sand-Martin.

Stomach examined—

7–6–08 1 *Gymnopleurus parvus.*
7 *Pyrrhocorids* sp. ?
1 Fly maggot.

Summary.—One bird contained 9 neutral insects.

The Swallows, Martins and Sand-Martins feed entirely on insects in the air, and are, I believe, always regarded as beneficial. They are noted in the Board of Agr. leaflets (No. 55) as taking *Tipulidæ* or Crane-flies which are of doubtful economic importance in India, and *Aphidæ* which are injurious in India as elsewhere. They are therefore to be regarded as beneficial.

MOTACILLIDÆ.

Wagtails & Pipits.

The food consists of seeds, insects, worms, small mollusca and crustaceans, usually procured on the ground. Wagtails hunt for flies round cattle.—E. B. C. N. H., 501.

Mostly on insects, a few only partake of grain or seeds.—Jerd. B. I., II, 211. They feed entirely on insects.—F. I., II. 285.

Some kinds of birds eat weevils (*Calandra oryzæ*) such as—Wagtails.—I. M. N., I, 28.

826. *Motacilla alba.*—White Wagtail.

Stomachs examined—

3–1–08. 12 *Phidole malinsi.*
4 *Hydrophilids.*
1 *Opatrum* sp.

Stomachs examined—contd.

8–1–08.	7	*Camponotus compressus.*
	2	*Philode malinsi?.*
	1	Weevil (head only).
	1	Small caterpillar.
	3	Small snails (*Hydrobia* sp.).
17–1–08.	4	*Hydrophilids.*
2–2–07.	7	*Rhyssemus germanus.*
3–3–07.	2	*Camponotus compressus.*
	1	*Phidole malinsi.*
	2	*Scleron orientale.*
	1	Bibionid fly.
	2	Small caterpillars.
5–3–08.	7	*Hydrophilids* of 3 spp.
12–4–07.	7	*Hydrophilidæ.*
	3	*Rhyssemus germanus.*
	4	Oat grains.
4–10–08.		*Hydrophilidæ.* (Approx. 10).
	2	Small caterpillars.
	1	Small seed.
29–10–08.	10	*Chrysocoris alba var. pallens.*
	2	Small caterpillars.
12–12–07.	2	*Chrysis* sp.
	3	Small beetles.
	2	Oat grains.

Summary.—Of 93 insects taken by 10 birds, 0 belong to the beneficial group, 10 to the injurious and 83 to the neutral. One bird had eaten snails, one small seeds and two had eaten oats.

5 birds took injurious insects, and 10 neutral.

Notes.—The food consists by no means of insects only; weed seeds are occasionally taken, oats from stables, not so far as I know from the field (crops or stubbles) and also small snails. I have seen it on more than one occasion eating worms.

827. *Motacilla leucopsis.*—White-faced Wagtail. Insects round houses, hedges, etc.—Jerd. B. I., II, 219.

829. *Motacilla personata.*—Masked Wagtail. Flies that infest the vicinity of stables and out-houses.—Jerd. B. I., II, 219.

Stomachs examined—

13–2–07.	16	*Phidole malinsi.*
	4	*Cremastogaster subnuda.*
	1	Small Elaterid.
	1	Small caterpillar.
	5	Oat grains.
29–3–07.	3	*Rhyssemus germanus.*
	5	Flies.

Stomachs examined—contd.

Other remains unidentifiable.
2 Pieces of grass.
29–3–07. 3 *Chrysis* sp.
5 *Rhyssemus germanus.*
3 Flies.
18 *Aphis* sp.
13 Oat grains.
9–4–08. 1 *Chrotogonus* (small larva).
3 *Camponotus compressus.*
1 *Cydnus nigritus.*
1–10–08. 1 Small Elaterid.
Myllocerus ? remains.
Probably also remains of flies.
2 Small snails (*Hydrobia* sp.).
3–12–07. 3 Flies.
21 Aphids.
1 Small snail.
12–12–07. Some insects' legs, weevils and ants, and the remains of broken beetle elytra.
3 Pieces of grass.

Summary.—Of 89 insects taken by 7 birds 45 are injurious, and 44 neutral. None are beneficial. 4 birds took injurious insects and 6 neutral, not including one in which only remains of insects were found. 2 birds took oats from around stables, 2 contained species of grass and 2 small snails.

Conclusion.—This bird is apparently beneficial.

831. *Motacilla madraspatensis.*—Large Pied Wagtail. Catching flies and insects by water's edge. B. N. H. S. J., XIII, 382. In captivity prefers insects except Hemiptera. Then in order grasshoppers, Mantidæ, caterpillars, crickets, flies, butterflies and wasps. It does not care for harder insects, therefore not liking beetles, and will not touch cockroaches or bugs. Also sandhoppers, annelids and Crustacea.—B. N. H. S. J., XI., 535. Flies. Dewar, B. P., 26.

833. *Motacilla borealis.*—Grey-headed Wagtail. Insects disturbed by cattle.—Jerd. B. I., II, 224.

Stomachs examined—

9–1–08. 1 Small Elaterid.
4 Elytra (*Coleoptera*).
8 Caterpillars ? mandibles.
7 Small caterpillars.
1 *Haltica ?* sp. ?
1 Spider.

Stomachs examined—contd.

4–4–09. 1 *Haliplus augustifrons.*
2 *Pachnephorus bretinghami.*
20 Hydrophilidæ (3 species).
4–4–09. 1 Small Elaterid.
24 Hydrophilidæ (3 species).
1 Small caterpillar.

Summary.—Of 66 insects taken by 3 birds, 18 are injurious, and 48 neutral. Three birds took injurious, and 3 neutral insects. One took a spider.

835. *Motacilla beema.*—Indian Blue-headed Wagtail.

Stomachs examined—

29–3–09. 4 Flies (Muscids).
3 *Heteroderes* sp.
1 *Cydnus nigritus.*
4–4–09. 7 Flies (Muscids).
1 *Heteroderes* sp.
2 Beetles' legs (possibly *Myllocerus* sp).
4–4–09. 9 Flies (Muscids)
Mesomorpha villiger.
6–4–09. 3 Flies (Muscids).
2 *Heteroderes* sp.
2 *Cydnus nigritus.*

Summary.—Of 36 insects taken 5 are injurious, 0 beneficial and 31 neutral. Three birds took injurious, 0 beneficial, and 4 neutral insects.

Notes.—Three birds obtained on 4-4-09 contained nothing identifiable except 100 (approx.) Aphides* which were probably obtained from "doub" grass as these birds were only noticed on grass lands, but the aphides could not be found on the grass ; 73 were in one bird.

Conclusion.—Probably beneficial.

839. *Limonidromus indicus.*—Forest Wagtail. Dung of cattle for insect larvæ (Layard, Ceylon).—Jerd. B. I., II., 227.

Pipits, chiefly feed on insects, but also eat grass seeds, and other grain.—Jerd. B. I., II., 300. Frequent the ground, but a few species occasionally perch on trees and even run along the larger boughs in pursuit of insects.—F. I., II, 301.

841. *Anthus maculatus.*—Indian Tree-pipit. Various insects, and also on seeds on ground and on trees. Said to kill

* Probably *Macrosiphum granarium*, the wheat aphis [H. M. L.].

many mosquitoes.—Jerd. B. I., II., 229. Millet. A. S. B. LXV., 81.

Stomachs examined—

1907. 31 specimens.
These invariably contained grass, weed seeds and vegetable-matter in major proportion. Most (23) also contained traces or, in a few cases, a large percentage of insect-remains, weevils and ants principally.

1908. 23 specimens.
Similar to those examined in 1907. 19 contained insects.

8–3–07. 1 *Bagrada picta.*
2 *Ephemerid* wings.
3 *Myllocerus* sp.
Grass and weed seeds.
1 Small pebble.

8–3–07. 3 *Phidole malinsi.*
2 *Cydnus nigritus.*
Grass and weed seeds.

18–3–09. 2 Ephemerids ?
2 *Tanymecus* sp. ?
1 *Bagrada picta.*
3 Hemiptera (heads).
12 Grass seeds.
1 Small pebble

18–3–09 2 Small weevils—*Myllocerus* sp. ? a considerable amount of other coleopterous remains, in all probability weevils.
3 Small seeds.
1 Small pebble.

18–3–09. 3 *Chrotogonus* sp. ? larvæ.
1 *Myllocerus* sp.
2 Small snails (*Planorbis* sp.).
1 Grass seed.

18–3–09. 2 Hydrophilids.
1 *Cydnus nigritus.*
Small broken *Coleoptera.*

20–3–08. 2 *Astycus ?* sp. ?
Grass and weed seeds.

26–3–07. Some broken Coleopterous remains (weevils).
1 *Drasterius* sp. (Pusa No. 2148).
1 *Cydnus* sp. (Pusa No. 543).
8 Small dark seeds.

26–3–07. 8 *Myllocerus* sp. *Tanymecus* sp.

26–3–07. 5 *Myllocerus* sp.
14 Hydrophilids. Apparently 5 species.

8–4–07. 3 *Chrotogonus* sp. larvæ.
2 Small snails.
Grass and weed seeds.

9–4–09. 1 *Myllocerus* sp.
Grass, and weed seeds.

20–4–07. 2 Aphodiids.
1 *Cydnus nigritus.*
Grass and weed seeds.

Summary.—Of 66 insects recorded from 67 birds 0 are beneficial, 37 injurious and 29 neutral. The number of insects in 42 of these birds, the insects being solely ants (neutral) and weevils (injurious), was not recorded. Eleven birds took vegetable-matter only, in all 64 birds containing vegetable-matter whilst 3 contained insects only. Two birds contained small snails.

Conclusion.—Beneficial.

842. *Anthus nilghirensis.*—Nilgiri Pipit. Various insects and grass seeds.—Jerd. B. I., II, 230.

843. *Anthus cockburniæ.*—Rufous Rock-pipit. Various insects.—Jerd. B. I., II, 236.

845. *Anthus richardi.*—Richard's Pipit. Various insects and grass seeds. "Ortolan."—Jerd. B. I., II, 233.

847. *Anthus rufulus.*—Indian Pipit.

Stomachs examined—

5-2-09.	12	*Myllocerus* sp.
	1	*Phidole malinsi.*
12-6-08	1	*Chrotogonus* sp.
	3	*Cremastogaster subnuda.*
		Phidole malinsi.
12-6-08.	14	*Termes* sp.
	1	Hemipterous head.
	1	Large spider.
5-7-08.		Blades and seeds of grass and other vegetable-matter.

Summary.—Of 33 insects taken by 4 birds, 27 are injurious, 6 neutral, none beneficial. Two birds took neutral insects, 3 injurious, 1 grass seeds and vegetable-matter, and 1 a spider.

853. *Oreocorys sylvanus.*—Upland Pipit. Insects and Grass seeds.—Jerd. B. I , II., 233. Grylli, and other insects and seeds.—Jerd. B. I., II., 240.

Almost without exception the Wagtails are winter visitors to the plains, one species apparently being a resident (*M. madraspatensis*). We have insufficient records at present for any definite conclusions, and though these birds are almost certainly beneficial, they can only be regarded in that light in so far as they keep down an excessive abundance of insect-life.

Of the Pipits, which take by far more vegetable-matter as food, the records point more definitely to the fact that they are beneficial. Eight or 9 species occur in the plains. At least two species are sold as "Ortolans," namely, *Anthus maculatus* and *Corydalla richardi*.

ALAUDIDÆ.

LARKS.

Feed partly on grains, and much on grasshoppers and insects. Jerd. B. I., II, 415.

854. *Alæmon desertorum.*—Desert-Lark. Seeds.—Jerd. B. I., II, 435.

855. *Otocorys penicillata.* Gould's Horned Lark. Grain found in cattle dung. (Dickson & Ross.)—Jerd. B. I., II, 430.

857. *Otocorys elwesi.*—Elwes' Horned Lark. Grain found in cattle dung. (Dickson & Ross). Jerd. B. I. II, 430.

861. *Alauda gulgula.*—Indian Sky-Lark. "An Ortolan."—Jerd. B. I., II., 435. This bird occasionally feeds on worms. I have seen the young fed on small moths, small grubs and caterpillars.

863. *Calandrella dukhunensis.*—Rufous Short-toed Lark. Feed on seeds. "An Ortolan."—Jerd. B. I., II, 435. Almost entirely "Ortolans."—F. I., II, 329.

The following are records from stomachs obtained in January, February and March 1908-1909 :—

1 Weevil.
29 Grass seeds.

5 Weevil and other insect-remains unidentifiable.
3 Grass seeds.

1 *Polyrachis simplex.*
4 Remains of weevils.
1 Caterpillar.
2 Grass seeds.

1 *Tanymecus* sp.
1 Small Geometrid caterpillar.
43 Grass seeds.

7 *Tanymecus indicus.*
13 Other insect-remains unidentifiable, probably entirely of weevils.
34 Grass seeds.

4 Weevils.
31 Grass seeds.
1 Piece of brick.

1 Weevil (legs only).
Some grass seeds and vegetable-matter.
3 Pieces of brick.

1 *Tanymecus indicus*.
1 Carabid. No. 2115.
Grass seeds and some vegetable-matter.

1 Weevil's leg.
211 Grass seeds.

3 Weevils (remains).
29 Grass seeds.

1 *Tanymecus indicus*.
8 Remains of other weevils.
9 Grass seeds.
2 Leguminous weed seeds.
1 Small stone.

2 *Tanymecus* sp.
151 Grass seeds.

10 *Tanymecus* (*hispida* and *indicus*).
43 Grass seeds.

1 *Tanymecus* sp. head only.
38 Grass seeds.
1 Small snail (*Corbicula orientalis* Lank).

1 *Mesomorpha villiger*.
Tanymecus indicus.
10 Insect-remains, probably of the above two species.
Grass blades and seeds.

1 Small weevil.
93 Grass seeds.

2 *Myllocerus discolor*.
40 Grass seeds and some vegetable-matter.
Insect-remains, possibly weevils.

10 Grass seeds.
1 Piece of snail shell (No. 15).
5 Small pieces of brick.

3 Weevils (legs only).
134 Grass seeds.

3 Weevils' legs.
8 Grass seeds.
3 Pieces of brick.

3 *Tanymecus indicus*.
6 Grass seeds.
2 Small shells. (No. 15).

7 *Mesomorpha villiger*.
1 *Myllocerus discolor*.
1 Wheat grain.
Some grass seeds and other vegetable-matter.

7 *Myllocerus blandus.*
9 Grass seeds ?

2 *Phidole malinsi.*
1 Small weevil.
9 Aphodiids.

1 Ant pupa.
2 *Myllocerus discolor.*
Some buds and grass seeds.
3 Small stones.

1 *Chrotogonus* sp.
1 Portions of a caterpillar.
Some beetle ? remains.

1 *Œcophylla smaragdina.*
3 Carabid and 5 weevil-remains.

1 *Œcophylla smaragdina.*
Beetle and weevil-remains.

Entirely on grass seeds.

4 Aphodiids.
Other coleopterous remains.
15 Grass and weed seeds.

1 *Scleron orientale.*
1 Weevils leg.
Grass and weed seeds.

Grass and weed seeds only.

6 *Tanymecus* sp.
1 Small snail (*Corbicula orientalis Lank*).
Grass and weed seeds and some vegetable-matter.

1 *Scleron orientale.*
5 *Tanymecus* sp.
1 *Myllocerus sp.*
14 Small grass and weed seeds.
2 Small snails (*Corbicula orientalis Lank*).
1 Small snail (*Planorbis* sp).

3 Anthomyiid flies.
1 *Hister œnescens.*
1 *Hister scissifrons.*
1 *Myllocerus blandus.*
3 *Œcophylla smaragdino.*

10 Grass seeds, and a little vegetable-matter.
5 Aphodiids.
1 *Myllocerus discolor.*
1 *Tanymecus (indicus).*
21 Grass and weed seeds.

1 *Myllocerus discolor.*
2 Weevils (heads).
63 Grass seeds, etc.

1 Forficulid clasper.
1 Small Elaterid.
1 Aphodiid.

Chiefly vegetable-matter.

1 Weevil.
1 Caterpillar.
3 *Cydnus* sp. (Pusa No. 543).

1 *Œcophylla smaragdina.*
1 *Amblyrrhinus poricollis.*
4 Moths. Noctuid or Pyralid ?
2 Small pieces of brick.

2 *Myllocerus* sp.
1 Ant Pupa. (*Camponotus compressus ?*).
1 Small caterpillar.
Some vegetable-matter.

4 *Myllocerus discolor.*

1 Muscid, *Stomoxys ?*

1 *Tetragonoderus* sp.
1 *Stenalophus quinquepustulatus.*
1 *Myllocerus discolor.*
2 *Amblyrrhinus poricollis.*
Some grass and weed seeds.
1 *Stomoxys ?*
1 Chironomid.

1 Forficulid clasper.
4 *Œcophylla smaragdina.*
1 *Camponotus compressus.*
1 *Mesomorpha villiger.*
3 Small black seeds.

Coleopterous remains.
2 Black seeds.

6 *Myllocerus blandus.*
Other weevil-remains.

Finely disintegrated coleopterous remains.

1 *Amblyrrhinus poricollis.*
Coleopterous remains, mostly of weevils.

1 *Chrologonus* sp.
4 Weevils.
1 Small caterpillar.
1 Hemipteron (head).

1 *Myllocerus discolor.*
3 Broken caterpllars.
Some vegetable-matter.

Coleopterous remains.
30 Grass seeds.

Coleopterous remains.
1 Piece of brick.

4 *Amblyrrhinus poricollis.*
Broken coleopterous remains.
3 Small pieces of brick.

Summary.—Of 230 insects taken by 53 birds, 6 are beneficial, 60 neutral, and 164 injurious. Three birds took beneficial insects, 17 neutral and 42 injurious. Forty birds took vegetable-matter ; in only two instances was the food composed entirely of this food. Thirteen birds had taken insects only. Five had taken snails, and one a wheat grain. A large proportion, at any rate, of the unidentifiable insects was probably weevils of common species.

Conclusion.—Beneficial.

871. *Mirafra erythroptera.*—Red-winged Bush-Lark.

Stomachs examined—

13–4–08.	3	*Myllocerus* sp.
	18	Leguminous weed seeds.
27–4–09.	1	*Camponotus compressus.*
	3	*Tanymecus* sp.
		Grass and weed seeds.
5–5–07.		Various coleopterous remains.
		Grass and other weed seeds.

Summary.—Six injurious insects and 1 neutral insect were taken by 3 birds. All contained weed seeds.

877. *Ammomanes phœnicura.*—Rufous-tailed Finch-Lark. Seeds of various kinds and hard insects.—Jerd. B. I., II, 423.

879. *Pyrrhulauda grisea.*—Ashy-crowned Finch-Lark. "Ortolan."—Jerd. B. I., II., 425.—Bombay Gaz., Ahmedabad, IV., 84.

The Larks feed on insects and seeds of various kinds. From the stomach records these seeds apparently consist for the most part of grass, at any rate in the common species. Most species are found in the plains. *Otocorys* are hill birds, while *Calandrella* are mostly winter migrants to the plains, other genera containing hill species, plains species or migrants.

Alauda gulgula, Calandrella 3 spp. and *Pyrrulauda grisea* are 5 species which are captured in large numbers and sold as "Ortolans," all being beneficial species.

NECTARINIIDÆ.

Sun-Birds.

These birds feed on the nectar of flowers and minute insects, and many chiefly on spiders.—Jerd. B. I., I, 359.

The Sun-birds...are entirely arboreal in their habits, and feed on minute insects, and on the nectar of flowers.—F. I., II, 343.

White-ants flying.—B. N. H. S. J., X, 303.

Sun-birds do not live exclusively upon honey. They vary this diet with minute insects which they pick off flowers and leaves. D. B. P. The food consists mainly of insects—sometimes taken on the wing—with their larvæ and spiders.—E. B. C. N. H., 570.

882. *Aethopyga seheriæ.*—Himalayan Yellow-backed Sun-bird. Larvæ of flies, spiders and ants. In captivity on sugar and water. honey, and bread and milk. (Sykes).—Jerd. B. I., I, 363.

886. *Aethopyga vigorsi.*—Vigors' Yellow-backed Sun-bird. Larvæ of flies, spiders and ants.—Jerd. B. I., I, 364.

887. *A. ignicauda.*—Fire-tailed Yellow-backed Sun-bird. Largely on honey secreted by the various species of *Rhododendron* found in the hills.—B. N. H. S. J., XV, 514.

888. *A. gouldæ.*—Mrs. Gould's Yellow-backed Sun-bird. Feeding young on insects.—B. N. H. S. J., IX, 500.

890. *A. saturata.*—Black-breasted Yellow-backed Sun-bird Common among wild cherry flowers.—A. S. B., LXIX, 125.

894. *Arachnechthra lotenia.*—Loten's Sun-bird. Spiders in verandah.—Jerd. B. I., I, 364.

895. *A. asiatica.*—Purple Sun-bird. Partly on nectar of flowers, but a good deal on insects, small cicadellæ, flies, spiders, etc.—Jerd. B. I., I, 371. Small insects off ground and on wing.—B. N. H. S. J., XIV, 364.

Stomachs examined—

8–2–09.	12	Tineid caterpillars.
15–2–08.	1	Spider.
20–2–08.	3	Small Geometrid larvæ.
	2	Small spiders.
18–2–07.	5	Small flies.
12–3–09.	5	Small Geometrid larvæ, probably obtained from a Sissoo tree.
17–3–07.	3	Small flies.
20–3–08.		(Empty).

Stomachs examined—contd.

11–04–09.		(Empty).
19–4–08.	2	Small flies.
	1	Spider.
15–5–08.		(Empty).
6–6–07.	4	Small flies.
20–8–08.		(Empty).
31–10–08.	1	*Myllocerus* sp.
	1	Small caterpillar.
	1	*Cydnus nigritus*.
	4	Jassids.
10–11–07.	2	Small flies.

Summary.—Of 43 insects taken by 14 birds, 27 are injurious. 16 neutral and none beneficial. Four birds took injurious insects, 5 took neutral (flies from flowers), 3 took spiders and 4 were empty. The last probably contained nectar, though this was not noted.

897. *A. pectoralis*.—Malay Yellow-breasted Sun-bird. Partial to flowers of coconut palms.—F. I., II, 362.

901. *A. zeylonica*.—Purple Rumped Sun-bird. Honey of flowers and small insects which infest flowers and buds, etc. In captivity on sugar and water or fruit jam.—Jerd. B. I., I, 369.

Arachnothera.—Affect the flowers of plantain trees (*Musa*), more than those of any other tree.—Jerd. B. I., I, 369.

906. *A. magna*.—Larger Streaked Spider-hunter. Insects off flower buds and leaves.—Jerd. B. I., III, 361.

DICÆIDÆ.

Flower-peckers.

Flower-peckers do great damage to ripe mangoes and guavas.—B. N. H. S. J., I, 623. Insects and small berries.—F. I., II, 375.

The food consists of insects varied by spiders, fruit-buds, seeds, and perhaps honey.—E. B. C. N. H., 571.

915. *Dicæum ignipectus*.—Fire-breasted Flower-pecker. Small insects and flower buds.—Jerd. B. I., I, 377.

918. *Dicæum virescens*.—Andamanese Flower-pecker. Fruit of *Loranthus*.—B. N. H. S. J., XVI, 161.

919. *D. erythrorhynchus.*—Tickell's Flower-pecker. Nectar of flowers and minute insects; Layard found that it ate occasionally viscous berries, probably those of a *Cuscuta.*—Jerd. B. I., I, 375.

Damage ripe mangoes and guavas.—B. N. H. S. J., XIV, 364.

2–3–07.		
6–4–08.		
16–4–07.		
9–10–07.		Young tamarind shoots.
12–11–08.		
13–11–07.		
20–11–07.		
11–4–09.		(Empty).
21–10–08.	1	Small moth.
		Some buds and shoots.

Summary.—Of 9 birds obtained 1 was empty, 7 contained shoots of tamarind, and 1 had taken a small moth, and a little vegetable-matter.

921. *Piprisoma squalida.*—Thick-billed Flower-pecker. Small spiders, insects' eggs and larvæ, aphides, etc.—Jerd. B. I., I, 377.

925. *Pachyglossa melanoxantha.*—Yellow-bellied Flower-pecker. Small insects and viscid berries.—(Hodgson in Jerdon B. I.), F. I., II, 386.

The heads of the Nectarinidæ and of the Dicæidæ, especially the former, are often noted as being covered with pollen from the various flowering plants that they frequent, some species notably *Arachnechthra asiatica* haunt orchards when the trees are in flower, and may therefore act to some extent as fertilising agents by carrying pollen from one flower to another. This is especially the case with bell-shaped flowers, such as ornamental hibiscus, pomegranate, etc.

Of the Sun-birds the species of *Æthopyga* are confined to the hills, while other genera occur at lower elevations and some in the plains (*Arachnechthra*). The *Dicæidæ* are similarly distributed, the greater number of both families occurring in Burma. The habits of both are alike. They feed on minute insects in flowers, and also on nectar, and occasionally do some damage to ripe fruits, especially mangoes.

PITTIDÆ.

Pittas.

Live habitually on the ground, and feed on insects.—F. I., II, 387.

927. *Pitta nepalensis.*—Blue-naped Pitta. Various hard insects.—Jerd. B. I., I, 504.

933. *Pitta brachyura.*—Indian Pitta. Various coleopterous insects.—Jerd. B. I., I, 504. White coffee grub in manure heap.—B. N. H. S. J., X, 303 ?

The Pittas, generally speaking, are confined to the hills of Assam and Burma. One species only is found more or less throughout India, namely, *Pitta brachyura.*

EURYLÆMI.

Broad-Bills.

Wallace says they do not capture insects on the wing, but pick ants and small *Coleoptera* off the bark and leaves of trees.—Jerd. B. I., I, 235-236. As a rule on insects.—Imp. Gaz., I, 246. Broad-bills are forest birds, living generally in small flocks among high trees and feeding as a rule on insects.—F. I., III, 3. Little but insects, taking them on the wing.—E. B. C. N. H., 468-469.

937. *Eurylæmus javanicus.*—Harsfield's Broad-bill. This species feeds on insects and small reptiles.—F. I., III, 4.

939. *Corydon sumatranus.*—Dusky Broad-bill. Small evil-smelling beetle.—B. N. H. S. J., XIV, 422.

940. *Cymborhynchus macrorhynchus.*—Black-and-red Broad-bill. Entirely insects.—F. I., III, 8. Berries.—E. B. C. N. H. S., 468.

942.—*Serilophus lunatus.*—Gould's Broad-bill. Is stated to live on fruit and berries.—Jerd. B. I., I, 239. Feeds chiefly on insects.—F. I., III, 9.

943.—*S. rubripygius.*—Hodgson's Broad-bill. Various insects.—Jerd. B. I., I, 239. It feeds on insects, and I have shot one in Manipore that had eaten small land mollusca.—F. I., III, 9.

944. *Psarisomus dalhousiæ.*—Long-tailed Broad-bill. I did not observe it capturing insects on the wing, but I found on examination that it had eaten locusts and Coccidæ.—Jerd. B. I., I, 237.

Feeds on insects which are sometimes captured on the wing.—F. I., III, 12.

945. *Calyptomena viridis.*—Green Broad-bill. Entirely on fruit.—F. I., III, 13.

The Broad-bills are mostly from Burma and the Malay Peninsula, extending to the Himalayas as far as Mussoorie.

PICI.

Wood-peckers and Wrynecks.

Picidæ.—All Indian *Picidæ* are insectivorous, a large proportion of them feeding mainly, and some entirely on ants.—F. I., III, 16.

Chiefly on insects and especially larvæ, which they discover by tapping on the trees, and when they find a likely spot they dig vigorously into it. A few of the Wood-peckers feed habitually on the ground on ants and other insects, and some (Piculets) appear to hop about brushwood and fallen trees. Some of the American Wood-peckers eat nuts and fruit, and even it is said eggs.—Jerd. B. I., I, 269.

Pici feed on wood-boring insects and are therefore of great use to the forester.—S. M. F. Z.

Wood-peckers extract the grubs and pupæ of *Hoplocerambyx spinicornis* from 'sal' trees.—S. Forest Bul. No. 2.

Many forms prey largely on ants. Others again devour a large quantity of fruits, seeds, and perhaps Indian-corn. Omitting, however, the sap-sucking propensities of the American species, the harm done is outweighed by the good.—E. B. C. N. H., 458.

According to Uzel, wood-peckers eat *Thysanoptera* (Thrips) under bark of trees.—Sharp C. N. H., Insects.—Part II, 530.

Almost entirely insects, picked out of the bark of trees and rotten wood.—Bom. Gaz., Deccan, Vol. XII, 35. Not a few birds confine their attention to the creeping things that inhabit the bark of trees. Such are the Wryneck, the Tree-creeper, and the Wood-pecker. Of these the Wood-pecker is chief.—Dewar, B. P., 84.

Gecinus obtain their insect-food more frequently on the ground and fallen trees than is usual with Wood-peckers.—F. I., III, 18.

946. *Gecinus squamatus.*—West Himalayan Scaly-bellied Green Wood-pecker. Small black ants are the favourite food; the Wood-pecker stands by the side of the ants' run, and picks them off as they come along.—A. S. B., LXIX, 164.

952. *G. chlorogaster.*—South Indian Yellow-naped Wood-pecker. (Layard) breaks into dried dung for insects. (Legge) ants, besides *Coleoptera.*—F. I., III, 25.

969. *Dendrocopus auriceps.*—Brown-fronted Pied Woodpecker. At Mussoorie destroys fruits, such as pears, etc. (Tytler).—Jerd. B. I., I, 274.

972. *Liopicus mahrattensis.*—Yellow-fronted Pied Woodpecker.

Stomachs examined—

22–5–08.	1 Small Elaterid.
	1 Small Hydrophilid.
	3 Geometrid larvæ.
5–7–08.	1 *Myllocerus* sp.
	1 Geometrid larva.
	4 Other caterpillars.
	1 *Monophlebus octo-caudata.*
	1 *Tachardia lacca.*
	Some *Ficus* fruits.
26–9–09.	14 *Amblyrrhinus poricollis.*
	5 Buprestid larvæ.

Summary.—Thirty-two birds took 32 insects, of which 29 are injurious, 2 neutral and one useful. One bird took *Ficus* fruit.

976. *Iyngipicus hardwickei.*—Indian Pigmy Wood-pecker. Various small insects and their larvæ.—Jerd. B. I., I, 278.

Stomachs examined—

10–4–08.	1	*Apis florea.*
	2	*Œcophylla smaragdina.*
	1	*Camponotus compressus.*
	5	*Cremastogaster subnuda.*
	4	Pupæ of small moths. (? found under bark).
13–5–07.	12	*Tanymecus* sp.
	3	Caterpillars.
		Other insect-remains unidentifiable.
17–7–09.	2	*Drasterius* sp. (Pusa No. 2148.)
	12	Small Elaterids.
	1	*Tanymecus* sp.
	1	Buprestid larva.
	1	Large Geometrid larva.

Summary.—Of 45 insects taken by 3 birds, 1 is beneficial, 22 neutral, and 22 injurious. One bird took beneficial insects and all had eaten injurious.

983. *Micropternus phœoceps.*—Northern Rufous Woodpecker. It feeds chiefly on ants that form nests in trees.—F. I., III, 56. The ants referred to are probably the common red ant, *Œcophylla smaragdina.*

Stomachs examined—

18–3–08.	1,459	*Cremastogaster subnuda.*
8–2–09.	2,600	*Cremastogaster subnuda.*
12–4–09.	725	*Crematogaster subnuda.*
	304	*Phidole malinsi.*
	23	*Œcophylla smaragdina* (pupæ).
	4	*Œcophylla smaragdina* (larvæ).
	9	Pieces of bark.

Summary.—5,115 neutral insects taken by 3 birds.

986. *Brachypternus aurantius.*—Feeds much on ants.—F. I., III, 60. Not a few birds confine their attention to the creeping things that inhabit the bark of trees, such as the Wryneck, the Tree-creeper and the Wood-pecker, and of these the Wood-pecker is the chief. It sometimes ventures on the ground from which it digs out insects.—Dewar B. P., 87.

Common in Indian forests: feeds on grubs and pupæ of the "sal" pest, *Hoplocerambyx spinicornis,* in Eastern Bengal and Assam.—S. M. F. Z., 1908.

Stomachs examined—

9–1–08.	3	*Camponotus compressus.*
	1	*Derosphœrus rugicollis.*
	21	*Myllocerus discolor.*
	3	Small caterpillars.
	1	Centipede.
	4	Ber (*Zizyphus jujuba*) buds.
21–1–07.	3	*Camponotus compressus.*
	2	Weevils sp. ?
	1	*Opatrum ?*
	2	*Mesomorpha villiger.*
8–3–09.	39	*Œcophylla smaragdina.*
	6	*Meranoplus bicolor.*
	1	*Copelatus indicus* (*Dytiscid*).
8–3–09.	33	*Myllocerus discolor.*
	3	*Myllocerus maculosus ?*
10–3–07.	19	*Œcophylla smaragdina.*
	1	*Opatrum* sp.
	2	or 3 Cerambycid larvæ.
	1	Piece of bark.
12–3–08.	12	*Œcophylla smaragdina.*
	4	*Camponotus compressus.*
	1	*Derosphœrus rugicollis.*
18–3–07.	23	*Phidole malinsi ?*
		Remains of ants entirely; almost empty.
23–3–07.	1	Ephemerid.
	19	*Myllocerus discolor.*
	1	*Derosphœrus rugicollis.*
	2	Geometrid caterpillars.
	1	Piece of bark.
12–4–08.	28	*Œcophylla smaragdina.*
	223	*Meranoplus bicolor.*
30–4–07.	3	*Camponotus compressus.*
	12	*Œcophylla smaragdina.*
	91	*Cremastogaster subnuda.*
	3	Caterpillars (one of which was a cutworm apparently).
13–5–07.	12	*Œcophylla smaragdina.*
	123	*Meranoplus bicolor.*
	3	Hemiptera (scutella).
15–5–08.	1	*Œcophylla smaragdina.*
	10	*Camponotus compressus.*
	12	*Myrmecocystus setipes.*
	37	Hemiptera spp.
	1	Spider.
	2	*Ficus* fruits.
20–6–07.	23	*Camponotus compressus.*
	16	*Œcophylla smaragdina.*
	3	*Opatrum* sp.
	1	Small caterpillar.
	1	*Cydnus* sp.
	1	*Ficus* fruit.

Stomachs examined—contd.

11-10-07.	301	*Meranoplus bicolor.*
	16	*Phidole malinsi?*
	1	*Myllocerus* sp.
11-10-07.	743	*Meranoplus bicolor.*
	3	*Astycus lateralis.*
	2	*Hemiptera* (heads).
12-12-08.	6	*Œcophylla smaragdina.*
	9	*Camponotus compressus.*
	1	Remains of *Opatrum* sp.
	1	Moth head.
	3	Hemiptera (scutella).
	1	Piece of bark.

Summary.—Of 3,921 insects taken by 16 birds, none are beneficial, 96 are injurious and 3,825 neutral. Thirteen took injurious insects, and all took neutral.

One bird took a centipede, 2 *Ficus* fruit, 1 Ber buds, and 3 pieces of bark. One took a spider.

This Wood-pecker occasionally feeds on the ground. By far the largest portion of its food consists of ants. It may frequently be seen hunting ants on Ber, and in consequence I have paid considerable attention to this bird, in order to ascertain whether, by hunting these ants, it may damage lac in any period of its growth. Most of the ant-hunting is done on stems and thick boughs. I have never seen it on a lac-infected part of a tree. It does not feed on the lac-insect. It is said to be very partial to toddy palms in Madras (B. N. H. S. J., XVI, 491); and it is possible that this habit may be due to the presence of *Oryctes rhinoceros* and *Rhynchophorus ferrugineus* in these trees.

987. *Brachypternus erythronotus.*—Red-backed Wood-pecker. Feeds largely on red ants.—F. I., III, 61. (*Œcophylla smaragdina?*)

988. *Tiga javanensis.*—Common Golden-backed Three-toed Wood-pecker. Feeds on caterpillars and pupæ of the bee-hole borer of the teak-*Duomitus ceramicus.*—S. M. F. Z.

Picumninæ.—Piculets.

1001. *Picumnus innominatus.*—Speckled Piculet. Various insects and according to Mr. Thompson on eggs and larvæ of wood-boring beetles.—F. I., III, 77.

Among decaying bark for insects.—Jerd. B. I., I, 301.

1002. *Sasia ochracea.*—Rufous Piculet. Entirely insects.—Jerd. B. I., I, 302.

Various insects, partly at all events *Coleoptera.*—F. I., III, 78.

Iynginæ.—Wrynecks. Feed chiefly upon the ground on ants and the like, and do not seek for insects under the bark of trees to the same extent that wood-peckers do.—E. B. C. N. H., 464.

1003. *Iynx torquilla.*—The Common Wryneck. Various insects, chiefly ants captured on the ground.—F. I., III, 78.

Chiefly ants off the ground or occasionally on the boughs of trees. Also ants' eggs (pupæ ?).—Jerd. B. I., I, 303.

Stomachs examined—

12-2-07.	205	*Phidole malinsi.*
13-3-07.	353	*Phidole malinsi.*
13-3-07.	4	*Camponotus compressus.*
	420	*Phidole malinsi.*
10-3-08.	95	*Phidole malinsi.*
	1	*Camponotus compressus.*
	4	*Myllocerus discolor.*
1-4-07.	72	*Phidole malinsi.*
16-4-07.	173	*Phidole malinsi.*
	1	*Myllocerus maculosus.*
16-4-07.	201	*Phidole malinsi.*
	6	*Camponotus compressus.*
	3	*Myllocerus discolor.*
26-9-09.	33	*Camponotus compressus.*

Summary.—Of 1,540 insects taken by 7 birds, 21 are injurious and 1,519 neutral, the latter being entirely composed of a small ant *Phidole malinsi.*

The Wryneck obtains most of its food on the ground among low crops. I obtained nearly all these specimens among cotton, which crop it especially appears to frequent. It is not a common bird and may easily be overlooked. I have not noticed it on the ground in the jungle : a winter migrant so far observed between the two following dates during the cold weather, September 26 (1909), and March 25 (1907).

Picinæ.—The Wood-peckers are not well represented on the plains. Of some 50 species recorded as Indian, only 10 or so occur

on the plains and some of these not on the plains proper. A large number are confined to Burma and the Malayan region.

Picumninæ.—The Piculets are entirely hill birds.

Iynginæ.—The Wryneck is a winter visitor to the plains and apparently an uncertain one, possibly its migration only occurs to localities with a suitable food-supply. This is especially noticeable at Pusa. In 1906-7 there was a considerable cotton crop and the birds were fairly numerous. In 1907-8 the cotton was less in area and few birds were heard or seen, one specimen only was obtained. Few specimens were seen or heard in 1908-9; the cotton crop had been abandoned, and it is possible that either its food is more abundant in the neighbourhood of cotton, or that the cotton plant forms good cover for the bird.

The family—*Pici*—feeds very largely on ants, and judging from the stomach records by no means so much on boring insects as is thought to be the case. They may be regarded as beneficial. The economic importance of, at any rate, the common plains species of *Pici* depends almost entirely on the economic importance we attach to ants.

ZYGODACTYLI.

Indicatoridæ.—Honey-guides. Said to disclose locality of bees' nests to share in spoil, and are sometimes found in bees' nests (dead).—Jerd. B. I., I, 306. Bees, grubs, and honey.—E. B. C. N. H., 452. Afford assistance in discovery of bees' nests.—Imp. Gaz., I, 247.

1004. *I. xanthonotus.*—Yellow-backed Honey-guide. In the stomach were several predatory wasps and a small quantity of green vegetable-matter.—F. I., III, 82. On bees swarming round a hole in a tree.—B. N. H. S. J., XIX, 153.

Capitonidæ.—Barbets. Indian species are occasionally insectivorous, but none except *Calorhamphus* feed much on insect-food.—F. I., III, 83. Barbets feed almost exclusively on fruits and berries.—Jerd. B. I., II, 308. Chiefly fruit.—Jerd. B. I., II, 309.

The food consists of fruit of every sort, buds and petals of flowers, and even green bark, or in many cases almost entirely of insects; in captivity pieces of meat or small birds are acceptable, the latter being usually battered upon some hard substance before being swallowed.—E. B. C. N. H., 249.

Fruit-eating Birds.—Imp. Gaz., I, 447.

I learnt, when in the Shevaroys, that barbets of some species, occasionally do some considerable amount of damage to coffee plantations, just as the berries are ripening. The pulp surrounding the seed is eaten, the seeds being discarded.

1006 & 1007. *Megalœma marshallorum.*—Great Himalayan and *M. virens*, Great Chinese Barbets.

Entirely on fruit.—F. I., III, 86, 85; & Jerd. B. I., I, 308. Fruit (*marshallorum*).—A. S. B., LXIX, 165.

1008. *Thereiceryx zeylonicus.*—Common Indian Green Barbet. Chiefly on fruit and seeds, and especially on the figs of the banyan and other kinds of *Ficus:* rarely insects.—F. I., III, 88. Layard.—One in captivity killed and ate munias. Fruits and berries, occasionally insects. Picking at the flowers of a tree. —Jerd. B. I., I, 311.

1907, 1908 & 1909. 21, 9, & 11 birds, examined in these three years respectively, contained nothing but fruits of various species of *Ficus* and occasionally Ber (*Zizyphus jujuba*).

Summary.—Forty-two birds took *Ficus* fruit, and 1 took 2 beneficial insects. This bird is a general fruit pest in the orchard at Pusa, and is said to take such fruits as loquats and peaches, visiting the orchard early in the morning and late in the evening only. I have seen it on several occasions taking white-ants (*Termes obesus*) on the wing. It flies straight from one tree to another, and if a termite happens to come in its way, it takes it. It is too clumsy in flight to hawk insects properly.

1010. *Thereiceryx viridis.*—Small Green Barbet. Always fruit in its stomach.—Jerd. B. I., I, 312.

1012. *Cyanops asiatica.*—Blue-throated Barbet.
Fruit broken up.—F. I., I, 313.

1015. *Cyanops flavifrons.*—Yellow-fronted Barbet. Fruit-eating.—F. I., III, 95.

1017. *Cyanops franklini.*—Golden-throated Barbet. Eating fruits.—Jerd. B. I., I., 314; & F. I., III, 97.

1019. *Xantholæma hæmatocephala.*—Crimson-breasted Barbet. Blyth found that in captivity one would take insects but not swallow them, and forsook them immediately fruit was offered. Its chief food is fruit of various kinds, sometimes perhaps insects.—Jerd. B. I., I, 316. Fruit, taking insects occasionally. Flying Termites.—F. I., III, 99. Taps trees like a wood-pecker, and feeds on fruit similar to green pigeon.—B. N. H. S..J., VIII, 12.

Does not touch insects: only insects eaten are termites caught on the wing.—B. N. H. S. J., VIII, 326. Robbed of *Ficus* fruit by *Molpastes bengalensis.*—B. N. H. S. J., XIII, 714.

Stomachs examined

1907 5 birds examined.
1908 7 ,, ,,
1909 3 ,, ,,
All contained *Ficus* only.

Summary.—Fifteen birds contained *Ficus* fruits only. I have repeatedly watched this bird at all seasons of the year, February, May, August, and September, for half an hour or so on end, pulling bits of bark off trees and especially dead branches, but when shot, the bird has contained nothing but fruit. If therefore this habit of tapping trees and pulling bark off branches, etc., is acquired for the purpose of finding suitable nesting sites only, this species has more than one brood during the year, or else its breeding season extends over a very large period. "It breeds in Northern India in March, April, and May, earlier further South, and in Ceylon from January to June."—F. I., III, 99.

Indicatoridæ.—One rare species occurs in the hills.

Capitonidæ.—Of the Barbets only two species occur in the plains, and both these are common. They feed almost entirely

on *Ficus* fruit, but other fruits are taken to some extent; in some localities coffee plantations suffer from ravages of these birds, and in others orchard fruits are taken in considerable numbers. Insect-food is seldom taken and these birds have nothing to recommend their protection.

ANISODACTYLI.

CORACIADÆ

Coracias and *Eurystomus.*—The food, largely procured when hopping on the ground, consists of small reptiles, frogs, beetles, worms, slugs, and grasshoppers, if not of grain.—E. B. C. N. H., 377.

1022. *Coracias indica.*—Indian Roller or Blue Jay. The Blue Jay is a good friend to the gardener, since it feeds exclusively on insects and small animals. Jerdon cites as the chief articles of its diet, large insects, grasshoppers, crickets, *Mantidæ*, and beetles with an occasional field mouse and shrew. To this he might have added frogs and small snakes.—D. B. P., 12.

Jerdon also states (B. I., I, 214): "When the winged termites issue from their nests after rain, the Roller, like almost every other bird, catches them on the wing." "It is sometimes trapped by bird lime, the bait being a mole cricket, or shrew (*Mus lepida*); (*Laggada lepida*, Watt, R., 51). Often seen in gardens and orchards, where it hawks insects, and sometimes feeds on lizards and mice.—Imp. Gaz., I, 248.

Stomachs examined—

14-1-08.	4	*Gryllotalpa africana.*
	2	*Œcophylla smaragdina.*
	2	Caterpillars ?
12-2-07.	1	*Gryllodes melanocephalus.*
	27	*Myrmecocystus setipes.*
	3	*Opatrum* sp. (*depressum ?*).
	2	*Trox indicus.*
28-2-07.	5	*Myrmecocystus setipes.*
	1	*Trox indicus.*
	6	Caterpillars.
9-3-08.	3	*Gryllotalpa africana.*
	6	*Myrmecocystus setipes* (winged).

Stomachs examined—contd.

	2	*Opatrum* sp. (*depressum*).
	3	*Trox indicus*.
22–3–07.	49	*Myrmecocystus setipes*.
	2	*Trox indicus*.
	4	Weevils ? *Myllocerus* sp.
	2	*Opatrum* (? sp. *depressum*).
	2	*Mesomorpha villiger*.
	2	Smooth lepidopterous larvæ.
24–3–09.	1	*Atractomorpha crenulata*.
	13	Claspers (forficulid).
	2	*Œcophylla smaragdina*.
	1	*Carabid* sp. ?
	4	*Trox indicus*.
	9	Cutworms (mandibles).
	17	Other mandibles ?
24–3–09.	2	*Atractomorpha crenulata*.
	4	*Chrotogonus* sp.
	1	Locustid sp.
	2	Grasshoppers (mandibles).
	1	*Camponotus compressus*.
	1	*Œcophylla smaragdina*.
	1	*Scarites* sp.
	1	Carabid grub.
	3	Caterpillars (mandibles).
		Other remains of insects.
1–4–07.	45	*Myrmecocystus setipes*.
21–4–07.	3	*Chrotogonus* sp.
	1	Tryxalid sp. larva.
	12	*Myrmecocystus setipes*.
	4	*Camponotus compressus*.
10–5–07.	10	*Chrotogonus* sp.
	5	*Œcophylla smaragdina*.
		Other insect-remains, probably *Myllocerus*.
	2	*Derosphœrus rugicollis*.
6–6–07.	3	*Schizodactylus monstrosus*.
	2	*Gryllotalpa africana*.
	14	*Myrmecocystus setipes*.
	1	*Gymnopleurus cyaneus*.
18–6–07.	4	*Chrotogonus* sp.
	1	*Tryxalis* sp.
	3	Grasshoppers ? (remains).
	1	*Gryllotalpa africana*.
	3	*Myrmecocystus setipes*.
	2	Coprid remains (two insects).
	2	*Trox indicus*.
	1	Chrysomelid sp.
	1	Large caterpillar (cutworm).
	1	Antenna of a Noctuid.
	1	Spider.
21–6–08.	2	*Gryllotalpa africana*.
	5	*Myrmecocystus setipes*.

Stomachs examined—contd.

	21	*Opatrum* sp.
		Other Coleopterous remains.
	2	*Gymnopleurus cyaneus* (? 2)
28-6-08.	7	*Chrotogonus* sp.
	9	*Camponotus compressus.*
	3	Small Coleop. elytra.
	1	*Lawana conspersa.*
28-6-08.	3	Grasshoppers.
	2	*Schizodactylus monstrosus.*
	2	*Myrmecocystus setipes.*
	1	Small ant, *Phidole?*
	1	*Trox indicus.*
	1	Leg of large Coprid. (*Catharsius sabæus?*).
12-10-07.	5	*Chrotogonus* sp.
	4	*Onthophagus spinifer.*
		Other legs unidentifiable.
	2	Remains of frogs.
30-10-07.	4	Remains of grasshoppers.
	4	*Myrmecocystus setipes.*
	1	*Opatrum depressum.*
	9	Jaws and other remains of insects.
31-10-08.	1	*Acridium æruginosum.*
	1	*Rhynchium* sp.
	1	*Opatrum* sp.
	1	Tenebrionid.
	9	Melolonthid larvæ (?) jaws.

Summary.—Of 412 insects taken by 18 birds, 4 are beneficial, 111 injurious, and 297 neutral. Three birds took beneficial insects, 17 injurious, and 18 neutral. Of the injurious insects taken, 52 are grasshoppers, 18 crickets, and 23 caterpillars, mostly cutworms. We can see then that the good done by the destruction of these injurious insects far more than counterbalances the fact that some beneficial insects were taken. One bird took a spider and another two frogs.

Notes.—This bird is widely distributed throughout India. It is very commonly seen along most Indian railways, being particularly fond of perching on telegraph wires. Its food, which consists almost exclusively of insects, is obtained nearly always on the ground. The Blue Jay chooses some exposed bough of a tree, often a dead one, or some such exposed post from which it can watch for insects on the ground, and when it sees an insect floats down to the ground silently and slowly, captures the insect,

eats it, and then flies off again. They occasionally sit on a lump of earth in a ploughed or cultivated field, and sometimes on grass itself on grass lands, and hawk their food from there. I have seen it capture and eat on the ground *Gryllodes melanocephalus*, *Gryllotalpa africana*, Ants (*Camponotus compressus*), Termites, beetles of various kinds (*Trox*, *Opatrum*, etc.) and also large beetle-grubs possibly Melolonthids. Insects are seldom captured on the wing, in fact, only when the flying Termites emerge in the early part of the rains, and at that time the Blue Jay feeds almost exclusively on these insects.

The young are fed largely on crickets and large grubs or caterpillars. I have only been able to observe one nest and did not discover this until the young were nearly ready to fly. The old birds are wary and give little chance for accurate observation.

On several occasions I have seen a Blue Jay attempt to rob a Magpie-robin's (*Copsychus saularis*) nest, which was in a hole in a tree, both when it contained eggs and young, but the robins succeeded in driving it off on each occasion. We may, therefore, conclude that at any rate sometimes the Blue Jay eats the eggs and the young of other birds.

At the breeding season the most extraordinary powers of flight are exhibited and it is from this that one of the bird's common English names—"Roller"—is derived. At other times the flight is lazy and slow, even when flying to the ground to obtain food, and gives one the impression that the bird could not be in a hurry if he tried.

Conclusion with Notes.

This bird is certainly beneficial. The plumage is very gaudy and it is possible that some numbers of this bird's skins are exported for sale or otherwise to other countries. But should this bird be protected, it is not only at the port of export that legislation is required. This much protection already exists. Being one of our common species of birds, and the gaudy colour very striking to any one new to the country, numbers of these birds are shot by

Europeans in order to send one or two wings home, and they are sent home not declared, or falsely declared. From what I have seen, I do not imagine that more than one out of six pairs of wings ever sees the destination for which they were originally obtained. Some specimens are not good enough, while others are put away, forgotten, and eventually thrown away. It is against this that protection is required.

1023. *Coracias affinis.*—Burmese Roller. Eating a young bulbul, it had apparently killed.—B. N. H. S. J., XVII, 193. Macdonald.

1024. *Coracias garrula.*—European Roller. In Asia it feeds chiefly on beetles.—Jerd. B. I., II, 219.

1025. *Eurystomus orientalis.*—Broad-billed Roller. Termites.—B. N. H. S. J., XII, 560.

Insects on Ground.—In confinement eats plantains.—F. I., III, 108. "Stated to take its prey more on the wing than the common rollers. Layard says that it clings to trees like a woodpecker and that he saw it tearing away the decayed wood round a hole in a dead tree. Their stomachs were, says he, full of wood-boring *Coleoptera*, swallowed whole, merely a little crushed and I saw them beat their food against the trees. *Coleoptera* in its stomach. Jerd. B. I., I, 220.

Broad-billed rollers. Termites.—B. N. H. S. J., VII, 417.

MEROPIDÆ.

Bee-eaters.

They feed on insects, often on wasps and bees, and hence their common name in English and other European languages, and they always capture them in the air. They usually crush their insect-prey when they seize it, killing it at once and thus do not get stung.—Jerd. B. I., I, 204.

Termites.—Jerd. B. I., I, 292.

They crush or beat the insect against their perch before swallowing it.—F. I., III, 110.

The larger species prey on bees. D. B. P., 209.

They hawk insects in the air; insects are also picked off the backs of cattle, and more rarely captured on the ground. E. B. C. N. H., 388.

1026. *Merops viridis*.—The Common Bee-eater.

Stomachs examined—

9–1–08.	14	*Apis indica*.
	2	*Myllocerus maculosus*.
	2	*Myllocerus discolor*.
	1	*Myrmecocystus setipes*.
	4	Moths wings, and remains. ?
2–2–07.	6	*Apis indica*.
	3	*Apis florea*.
2–2–07.	4	(5 ?) *Apis indica*.
12–3–07.	4	*Apis indica*.
	3	*Myllocerus discolor*.
	5	Aphodiids.
12–3–08.	3	*Apis florea*.
	1	*Chrysis* sp.
14–3–07.	2	*Apis indica*.
	8	*Apis florea*.
24–3–09.	5	*Apis indica*.
	4	*Apis florea*.
	2	Diptera (heads.)
4–4–07.	6	*Apis indica*.
4–4–07.	3	*Apis indica*. ?
	7	*Apis florea*.
10–4–09.	8	*Apis* sp. from hive.
10–4–08.		Crickets' ? wings.
	3	*Apis florea*.
21–4–07.	12	*Apis florea*.
	6	Moths. Remains of 3 ? more moths.
	1	*Myllocerus discolor*.
21–4–07.	3	*Myrmecocystus setipes*.
	2	*Myllocerus maculosus*.
14–5–07.	7	*Apis indica*.
14–5–07.	13	*Apis indica*.
4–6–08	4	*Chrotogonus* sp.
	4	*Polistes hebræus*.
	1	*Vespa orientalis*.
	1	Carabid (legs only).
	1	Spider.
22–5–08.	14	*Apis florea*.
6–7–08.	1	Fly (*Lucilia* ?).
	1	Coprid.
	1	Cricket (Trydactylid).
	1	*Chrysis* sp.
27–7–08.	6	*Apis florea*.
	1	*Chrysis* sp.

Stomachs examined—contd.

	1	*Myllocerus discolor.*
6–8–08.	2	*Gymnopleurus parvus.*
	4	*Apis florea.*
	1	Chrysomelid sp.
21–8–08.	16	*Apis florea.*
	1	*Myllocerus* sp.
24–8–08.	1	*Apis florea.*
	1	Carabid sp.
	1	*Onthophagus spinifer.*
	1	Carabid (*Tetragonoderus.*)
	5	Flies (Muscids ?).
31–9–08.	1	*Halictus* sp.
	6	Diptera (House ? flies).
4–10–08.	4	*Camponotus compressus.*
	1	*Tiphia* sp. (Scoliid).
	1	*Halictus cuniculus* (*Apid*).
	1	Weevil.
	1	*Balaninus* sp.
	1	*Onthophagus spinifer.*
	1	*Myllocerus maculosus.*
9–10–08.	1	Dragon fly.
	3	*Apis indica.*
	1	*Polistes hebræus.*
	1	*Sphex lobatus.*
	1	Tabanid.
12-10–07.	12	*Apis florea.*
	2	Moth remains.
	1	*Myllocerus* sp.
12–10–07.	7	*Apis indica.*
20–10–08.	2	*Apis florea.*
	3	*Myllocerus discolor.*
	1	Chrysid sp.
21–10–07.	3	*Apis florea.*
	2	*Coccinella 7-punctata.*
	1	*Myllocerus discolor.*
	1	*Gymnopleurus miliaris.*
12–11–08.	9	*Apis indica.*

Summary.—Of 284 insects taken by 30 birds, 202 are beneficial, 41 injurious, and 41 neutral. Twenty-six birds took beneficial insects, 15 injurious and 12 neutral.

Of the beneficial insects taken practically 200 are the two common species of bees in the plains: these bees probably play a very important part in the fertilisation of various fruit trees. The smaller variety—*Apis florea*—is always present in great numbers on mangoes when in flower and on all garden fruits, such as peaches,

loquats, &c. One bird took a spider. I believe this bird takes many more smaller insects than the records show.

Notes.—During the rains of the present year (1909) and in the hot weather previous to the rains these birds were a great nuisance round the Bee-hives at Pusa. They feed at such times almost entirely on the bees taking them as they leave or enter the hives. In spite of repeated efforts to stop these birds by destroying such as were near the hives, no sooner had one or two been shot than more came. In the beginning of July two young queen-bees had hatched and both these disappeared on their fertilisation flight, and I believe were taken by the Bee-eaters. They did not move from the hives in order to take up new quarters for then some of the bees would have swarmed with them. The failure of the bees at Pusa is, I believe, almost entirely due to the presence of these birds. A party of 6 or 7 Bee-eaters was always in the neighbourhood, and even when the hives were being examined would come and take the bees. They are quite fearless and will take bees hovering round the frame one is examining, almost brushing one's face in so doing. The following is a list of the stomach contents of 13 of these Bee-eaters shot in the vicinity of the Bee-hives during 1909.

10–4–09.	8 Bees.
12–4–09.	6 Bees.
12–4–09.	3 Bees.
	2 Muscids.
25–4–09.	4 Bees.
12–4–09.	11 Bees.
5–5–09.	9 Bees.
5–5–09.	7 Bees.
	2 *Mylloccrus maculosus.*
26–5–09.	4 Bees.
12–6–09.	3 Bees.
12–6–09.	6 Bees.
7–7–09.	4 Bees.
	2 *Mylloccrus maculosus.*
7–7–09.	9 Bees.
7–7–09.	12 Bees.

Summary.—Of 92 insects taken by 13 birds, 86 are bees from the hives, 2 are neutral, and 4 injurious. Ten birds had taken bees only.

Putting these results with the first lot summarised we have—

Of 376 insects taken by 43 birds, 300 are beneficial, 53 injurious, and 23 neutral. Forty-two birds took beneficial insects, 17 injurious, and 7 neutral.

Conclusion.—Though generally regarded as beneficial "because it is insectivorous" the notes and records of the stomach contents made at Pusa during the last $2\frac{1}{2}$ years certainly show it to be injurious. This may have local application only, but it is injurious here at Pusa, and in similar districts. Should Bee-keeping ever be taken up commercially in the plains, and there seems every chance that such will be the case, this bird will prove one of the worst pests to the Bee-keeper.

I believe, however, that the food of this species is not sufficiently known. From watching birds feeding they apparently take many more small insects than these records denote; such insects probably consist of a variety of small moths and flies; small beetles perhaps are taken to a greater extent than any other form of food.

A common resident though not so common during May to August or December and January as during other months. This Bee-eater is purely insectivorous and may be seen singly or in small parties waiting on trees, posts, telegraph wires and even lumps of earth in the middle of fields and swooping at insects as they fly by. It does not remain so long on the wing as *M. philippinus.*

Its food consists principally of bees and other *Hymenoptera*, small beetles especially *Myllocerus* sp. moths, crickets, etc. Moths of various sorts, Noctuids and Pyralids, one of which was *Ancyllolomia chrysographella*, have, on several occasions, been seen to be taken, but being soft insects they are, as a rule, impossible to identify in contents of stomach, especially as larger insects at any rate are battered about a good deal before being eaten. If a Bee-eater captures a fairly large insect or one that can sting, it invariably kills it by striking the lower mandible on its perch and in so doing often breaks the insect.

Dewar (Birds of the Plains) remark that "the large species" (of *Meropidæ*) "prey upon bees hence the popular name, but I doubt whether the little *Merops viridis* tackles an insect so large as a bee. It feeds on smaller flying things, which it captures on the wing." In addition to such insects as *Apis indica* and *Apis florea*, our two common bees, *M. viridis* takes *Polistes hebræus*, *Sphex lobatus* and *Chrotogonus*, all larger than these bees, and I have also seen *Melanitis ismene* captured and large dragon-flies (*Crocothemis servillia*). From the *post-mortem* records, bees apparently form the greatest percentage of its food. On several occasions I observed one of these birds capturing bees as they were entering the Bee-hives at Pusa, and on shooting this bird I found it contained eight workers. I have never seen it taking bees from wild nests. Jerdon (B. I., I, 204) gives an excellent account of this bird's habits and states that it "captures insects with an audible snap while on the wing and frequently takes two or three insects before it re-seats itself on its perch" and adds, "I have seen one occasionally pick an insect off a branch, or a stalk of grain or grass, and Mr. Blyth informs me that he had seen a number of them assembled round a small tank, seizing objects from the water in the manner of a Kingfisher."

1027. *Merops philippinus*.—Blue-tailed Bee-eater. Now and then pick an insect off the surface of the water. They feed on wasps, bees, dragon-flies, bugs, and even on butterflies which I have seen this species frequently capture.—Jerd. B. I., I, 208.

Bees form a portion of its diet.—F. I., III, 1 2

Stomachs examined—

4-4-09.	6	*Platygomphus dolobratus*
	1	Dipteron.
4-4-09.	1	*Trithemis pallidernervis.*
	1	*Apis indica.*
	1	*Xylocopa dissimilis.*
	1	*Megachile carbonaria.*
4-4-09.	3	*Trithemis* sp.
	2	*Megachile carbonaria.*
4-4-09.	1	*Megachile carbonaria.*
	1	Dragon-fly sp.
12 4-09.	9	*Apis florea.*

Stomachs examined—contd.

7–5–09.	1 *Crocothemis servillia.*
	5 *Apis indica.*
	2 *Apis florea.*
20–5–08.	7 *Apis indica.*
	2 *Apis florea.*
	1 *Chrysis* sp.
	3 *Rhynchium* sp.
20–6–08.	1 *Camponotus compressus.*
	4 *Œcophylla smaragdina.*
	1 Small beetle.
7–7–08.	1 *Apis indica.*
	7 *Apis florea.*
	1 *Rhynchium bengalense.*
28–8–08.	1 *Polistes hebræus.*
	1 *Gymnopleurus parvus.*
8–10–07.	9 *Apis florea.*
	4 *Apis indica.*
9–10–08.	2 *Myllocerus discolor.*
12–10–08.	1 *Polistes hebræus.*
	1 *Vespa orientalis.*
	1 Coprid sp.

Summary.—Of 83 insects taken by 13 birds, 70 are beneficial, 3 injurious and 10 neutral. Ten birds took beneficial insects, 2 injurious and 4 neutral.

Notes.—This bird hawks its prey more in the neighbourhood of water than does *M. viridis.* It also keeps longer on the wing and does not hawk so near the ground. Insects are, however, frequently taken just over the surface of water. These birds are commoner in the hot weather and rains than in the cold weather and usually occur in small flocks of from 4 to 12 birds.

On several occasions I have seen Noctuid moths taken. At times its food consists entirely of the common wasp—*Vespa orientalis,*—and on dull days when dragon-flies are inclined to sit on grass-stems this bird feeds almost entirely on these insects then. *Crocothemis servillia* is one species I have seen taken in large quantities on such times.

On one occasion I noticed about 40 of these birds hawking insects over a large wood-stack, and they were apparently at the same place for some considerable time. They were feeding presumably entirely on two species of wood-boring beetles—*Dino-*

derus minutus and *Sinoxylon anale*—the only two insects I could see on the wing at the time. A large proportion of the insects taken were seen to be these two insects. The fact that it takes these Wood-borers may be of some little value, if the bird occurs in districts where these stacks exist. Considerable damage is at times done to wood in stacks (I saw, at Quetta, a great deal of wood practically ruined by borers of various kinds which had attacked it after it had been stacked), and the presence of these birds is then of some value as a check on these insects. I have not observed this habit with *M. viridis*, but considering the general similarity in the feeding habits of the two species, we may certainly assume that *viridis* will take these insects.

1028. *Merops persicus.*—Blue-cheeked Bee-eater. Said to line its nest with Dragon-flies wings.—S. J. Pt. I., C. N. H., 424.

1029. *Merops apiaster.*—European Bee-eater. *Polistes hebræus.*—B. N. H. S. J. XIV, 627.

Nest holes in which were strewn remains of beetles and winged insects.—B. N. H. S. J., XVI, 749. Said to line nest with elytra and legs of beetles.—Jerd. B. I., I, 211. This and other large Bee-eaters feed on various insects chiefly bees and wasps.—F. I., III, 114. In Spain is a perfect pest to the bee-keeper, catching the workers as they enter and leave the hive.—E. B. C. N. H., p. 388.

1030. *Melittophaga swinhoei.*—Chestnut-headed Bee-eater. "Gnats over water (probably ephemerids C. W. M.). "Blue Dragon-fly. Larvæ and eggs of mosquitoes."—B. N. H. S. J., X, 540. Small black beetles on sand (not flying). Usually feeds as other Bee-eaters, on insects on wing.—B. N. H. S. J., XII, 561.

1031. *Nyctiornis athertoni.*—Blue-bearded Bee-eater.—B. N. H. S. J., XII, 60. Bees: beetles. Remains of bees, beetles and wasps stored in nesting holes.—B. N. H. S. J., VI, 333. Bees: leaf and flowers hunted for insects. Eggs eaten by Khasias, so few clutches get hatched.—B. N. H. S. J., XVII, 965. Its food is bees and wasps, also Scarabæi, Cicadæ, etc.—Jerd. B. I., I, 212.

HALCYONES.

Kingfishers.

The Kingfishers are a well-known tribe, most of them diving in the water for small fishes, others eating crabs, insects and reptiles.—Jerd. B. I., I, 220.

The chief enemies with which the fish (trout) have to contend are Otters, Kingfishers, etc.—B. N. H. S. J., XVI, 381.

Water-Kingfishers. –Not entirely piscivorous, but eat insects and small crustaceans especially when they seek the sea shore, as do several species of Halcyon, Alcedo and Ceryle, towards winter.—E. B. C. N. H., 383.

Wood-Kingfishers. Insects caught in the air, caterpillars, reptiles, frogs, crustaceans, worms, and mollusca, though they occasionally eat fish.—E. B. C. N. H., 384. Fish from tanks.—Bengal Gaz., Monghyr, 22.

1033. *Ceryle varia.*—Indian Pied Kingfisher. Entirely fish.—Jerd. B. I., I, 234, and F. I., III, 120.

Stomachs examined—

12–1–07.	Fish.
8–3–07.	Fish.
18–3–08.	Fish.
21–5–07.	Fish.
11–11–08.	Fish.

Summary.—Five birds had fed entirely on fish.

1034. *Ceryle lugubris.*—Himalayan Pied Kingfisher. Entirely fish.—Jerd. B. I., I, 234, and F. I., III, 121.

1035. *Alcedo ispida.*—Common Kingfisher. Small fish, tadpoles and aquatic insects.—Jerd. B. I., II, 231. Mainly fish, and occasionally tadpoles and aquatic insects.—F. I., III, 123. Fish.—Bom. Gaz., Cutch, Vol. X, p. 65.

1038. *Alcedo grandis.*—Blyth's Kingfisher. Fish (chiefly or wholly).—F. I., III, 126.

1039. *Alcedo euryzona.*—Broad-zoned Kingfisher. Fish entirely.—F. I., III, 126.

1040. *Ceyx tridactyla.*—Indian Three-toed Kingfisher. Exclusively small fish and aquatic insects.—Jerd. B. I., I, 230 & F. I., III, 128.

1041. *Pelargopsis amauroptera.*—Brown-winged Kingfisher. Feeds chiefly on fishes.—Jerd. B. I., I, 224.

1043. *Pelargopsis gurial.*—Brown-headed Stork-billed Kingfisher. Fish, rats and occasionally frogs.—Jerd. B. I., I, 223. Fish, also frogs, crabs, molluscs and lizards.—F. I., III, 131. Fish, small lizards, crabs, prawns, birds' eggs, mynah's young.—B. N. H. S. J., X, 540.

Halcyon.—This genus feeds on rats, grasshoppers and other insects.—Jerd. B. I., I, 222.

1044. *Halcyon smyrnensis.*—White-breasted Kingfisher. Kingfishers appear to be almost as omnivorous as toads, and Eha on page 26 of his Common Birds of Bombay mentions how this White-breasted Kingfisher (*H. smyrnensis*) feeds on frogs, water insects, crabs, etc., and even swallows small birds when kept in an aviary. We have certainly seen them dive on to dry land and capture lizards, *Calotes versicolor.*—B. N. H. S. J., XVI, 758. Small birds in dry weather.—B. N. H. S. J., XIII, 184. In captivity. Fish, meat, lizards, shrimps, grasshoppers.—B. N. H. S. J., XIII, 365. Fish, crabs and insects.—B. N. H. S. J., XII, 562. Land-crab, mouse, lizard, grasshopper or other insect. Near water, fish, tadpoles and water insects. Layard states that he has seen it seizing butterflies.—Jerd. B. I., I, 225. Occasionally fish, chiefly insects, small lizards, sometimes mice, or land-crabs.—F. I., III, 133. Often far from water, living on insects, small reptiles, etc.—B. N. H. S. J., XVII, 965. Chiefly insectivorous.—Imp. Gaz. I, 248. Grasshoppers and locusts. A pair of these birds was observed day after day in Madras city, and no food was seen to be captured other than these insects. The food is taken to the top of a tree and then eaten. I have also seen the bird taking grasshoppers at Pusa and Chindwara, once at Pusa (10-4-08) eating a lizard. I once saw a cricket (*Brachytrypes achatinus*) taken from the wall of a

bungalow verandah. These crickets are largely eaten during the rains.

1045. *H. pileata.*—Black-capped Kingfisher. Fish and insects.—Jerd. B. I., I, 226. Fish and crabs.—F. I., III, 134. Fish and beetles (*H. surinamensis*).—B. N. H. S. J., XIII, 379. Land-crabs.—B. N. H. S. J., XI, 164.

1046. *Callialcyon lilacina.*—Ruddy Kingfisher. Insects, small reptiles.—B. N. H. S. J., X, 540.

1047. *Sauropatis chloris.*—White-collared Kingfisher. Feeds largely on grasshoppers as well as fish.—B. N. H. S. J., XVII, 163. Small crabs and molluscs.—Bombay Gaz., Cutch, Vol. X, p. 64.

1048. *S. occipitalis.*—Blyth's White-collared Kingfisher. Lizards and shell fish.—F. I., III, 137.

1049. *Caridagrus concretus.*—Sumatran Kingfisher. Lizards and large wood lice.—F. I., III, 138.

1050. *Carcineutes pulchellus.*—Banded Kingfisher. Lizards and various insects.—F. I., III, 139.

Bucerotidæ.

Hornbills live almost entirely on fruit, which they swallow whole. In captivity they will eat small birds, mice, meat, rice or anything that is offered to them. It is said that some of the African species live on reptiles, beetles and even on carrion.—Jerd. B. I., I, 240-241.

Bucerotidæ.—Fruits and insects—the latter occasionally hawked for in the air, constitute the normal food, but the larger forms devour small mammals, birds, eggs and reptiles, with grubs, flowers and young shoots. Berries of *Strychnos* and figs seem greatly in favour.—E. B. C. N. H., 392. Hornbills are all mainly frugivorous.—Imp. Gaz., I, 249.

1051. *Dichoceros bicornis.*—The Great Hornbill. Snails, beetles and centipedes, will eat fruit, lizards, snakes and insects.—B. N. H. S. J., X, 400? Food consists mainly of fruit, but insects and lizards are also eaten. Tickell— F. I., III, 143. Fruit (fig, etc.),

the only food in the wild state of this, as of most other, Indian Hornbills.—Jerd. B. I., I, 244. It is also said to eat plantains, banyan, wild fig, lizards, mice, scorpions; and kills and eats snakes; ripe berries and fruit. Ripe berries and fruits; snakes.—Bombay Gaz., Cutch, Vol. X, p. 65.

1052. *Anthracoceros coronatus.*—Malabar Pied Hornbill. Fruit and berries, especially kuchla (*Strychnos nux-vomica*). "Banian and other figs".....White notices that one he examined had eaten an egg.—Jerd. B. I., I, 246.

1053. *A. albirostris.*—Indo-Burmese Pied Hornbill. Chiefly fruit and berries: also noticed by Mr. Inglis to catch and eat fish. "Very fond of snakes (Ramsay)."—F. I., III, 146. Lizards, small fish: feeds much on the ground both on fallen forest fruit and also on any odd animal food it can pick up.—B. N. H. S. J., XVII, 966. *Ficus* fruit.—A. S. B., LXIX, 129.

1054. *Rhytidoceros undulatus.*—Malayan Wreathed Hornbill. Entirely on fruit (almost).—F. I., III, 147.

1055. *R. subruficollis.*—Blythe's Wreathed Hornbill. Entirely on fruit.—B. N. H. S. J., XVII, 966.

1056. *R. narcondami.*—Narcondam Hornbill. Figs exclusively.—B. N. H. S. J., XVI, 620.

1057. *Aceros nepalensis.*—Rufous-necked Hornbill. Food similar to other hornbills.—F. I., III, 150. Fruit of various kinds and in captivity meat (raw or dressed), fruit, rice made into balls with ghee, etc.—Jerd. B. I., I, 251.

1060. *Ptilolæmus austeni.*—Godwin-Austen's Hornbill. Besides fruit, mantids, blattæ and locusts.—F. I., III, 153.

1061. *Berenicornis comatus.*—Long-crested Hornbill. Often feeding on ground and eating lizards, etc., as well as fruit.—F. I., III, 154.

1062. *Lophoceros birostris.*—Common Grey Hornbill. Chiefly fruit but occasionally insects.—F. I., III, 156. Chiefly fruit, especially figs of banian, pipal and other fig trees, sometimes

however, feeding on large insects, on one occasion I found that it had eaten *Mantids* and *Locustidæ*.—Jerd. B. I., I, 249.

Stomachs examined.—

Pusa 11-11-07. Figs.
1-2-08. Figs.
4-3-08. Figs.
12-4-07. Figs.
12-4-07. Figs.
12-10-08. Figs.

None of the specimens I have examined have contained insects. All 6 birds contained Ficus fruit only.

1063. *L. griseus*.—Malabar Grey Hornbill. Fruit.—F. I., III, 157. Fruit of various kinds.—Jerd. B. I., I, 250.

1064. *L. cingalensis*.—Ceylonese Hornbill. Fruit.—F. I., III, 158. Fruit of various kinds.—Jerd. B. I., I, 250.

UPUPIDÆ.

Hoopoes.

Hoopoes are ground feeders.—Jerd. B. I., I, 390. The Hoopoes feed on the ground on grubs and insects.—F. I., III, 159. The food consists of flies taken on the wing, insects generally and worms, individuals being frequently observed climbing rocks or branches of trees in search of prey, and carefully examining heaps of refuse.—E. B. C. N. H., 395.

1066. *Upupa epops*.—European Hoopoe. Insects and especially grubs which they extract with their long bills from some distance beneath the surface.—F. I., III, 161.

1067. *Upupa indica*.—Indian Hoopoe. It feeds entirely on the ground...and picks up various insects as *Coleoptera*, ants, small grasshoppers, and as Mr. Burgess informs us the larvæ of the ant-lion (*Myrmeleo*). It frequently searches the dung of cattle for grubs and other insects.—Jerd. B. I., I, 392.

Stomachs examined—

12-1-08. 3 *Opatrum* sp.
5 Lepidopterous larvæ (cutworms).
1 Fly puparium.

Stomachs examined—contd.

	3	Hemiptera (scutella).
		Grass leaves and a few seeds.
3-2-07.		Nothing identifiable.
		Minute fragments of insects probably all *Coleopterous*.
10-2-07.	5	*Anomala varians*. Larvæ.
26-2-08.	1	*Polistes hebræus*.
	8	Elaterid larvæ.
	8	*Agrotis* larvæ.
10-3-07.	12	Cutworms. *Agrotis* s
12-3-08.	1	*Chrotogonus* larva.
	2	*Gryllodes melanocephalus*.
	3	*Camponotus compressus*.
	2	Cutworms. (*Agrotis* sp.)
1-4-07.	8	Various Tenebrionid remains.
	2	*Opatrum depressum*.
	1	,, *maculatum*. (?)
	4	*Opatrum* sp.
	6	Cutworms. (*Agrotis ?* sp.).
3-4-09.	1	Coprid sp.
	15	Noctuid larvæ (cutworms ?)
	1	Geometrid larvæ.
	1	Snail. (*Bythinia* sp.)
	2	Bits of brick-tile.
11-4-09.	11	Cutworms.
	1	Leg of a Carabid ?
	1	Spider.
	1	Blade of grass.
12-4-09.	6	*Myllocerus discolor*.
	1	Moth's head.
	7	Cutworms (*Agrotis* sp).
	2	Hemiptera (*Cydnus ?*)
13-4-08.	3	*Gryllotalpa africana*.
	7	*Myrmecocystus setipes*.
	3	*Camponotus compressus*.
	1	*Anomala pallida*. (?)
	7	Cutworms.
		Unidentifiable matter probably remains of caterpillars.
29-4-08.	2	*Schizodactylus monstrosus*.
	1	*Gryllodes melanocephalus*.
	6	Remains of ? Tenebrionids.
1-5-07.	2	*Schizodactylus monstrosus*.
	1	Cutworm.
20-5-07.	1	Elaterid grub.
	5	Geometrid larvæ.
	3	Remains of 3 other caterpillars.
	1	Moth ? *Caradrina exigua*.
28-5-08.	1	*Chrotogonus* sp. L.
	5	*Myrmelea* larvæ and four pairs jaws.
	9	*Cydnus nigritus*
	1	*Monophlebus stebbingi*.
	5	Caterpillars.

Stomachs examined—contd.

	1	Small caterpillar.
	1	Spider.
12-6-07.	6	*Anomala varians*, L.
19-6-07.	3	*Chrotogonus* sp. L.
	3	*Œcophila smaragdina*.
	3	*Myrmecocystus setipes*.
	1	*Phidole* (?) sp. *malinisi*.)
	1	Coprid leg ?
28-6-08.	1	*Neuropterous* larva ? *Myrmeleo*.
	14	Legs and insects remains, beetles and ants.
	1	*Melolonthid* (?) (*Anomala*) leg.
	6	Caterpillars, 4 kinds.
10-7-08.	2	*Gryllotalpa africana*.
	1	Moth (? *Plecoptera reflexa*).
	6	*Cydnus nigritus*.
14-7-08.	7	*Termes* sp.
9-9-08.	11	*Onthophagus spinifer*.
	1	Carabid. (part of elytron).
	1	*Aphodiid* (2106).
	5	*Anomala varians*, L.
3-10-08.	1	Forficulid clasper (?) *Chelisoches melanocephalus*
	1	*Opatrum* sp.
	1	Jaw of a caterpillar.
	1	Spider.
		(practically empty.)
10-10-07.	1	*Chrotogonus*.
	6	*Opatrum depressum*.
	3	Cutworms.
	2	Two or three broken caterpillars.
10-11-07.	1	Small green caterpillar.

Summary.—Of 278 insects taken by 24 birds 13 are beneficial, 180 injurious and 85 neutral. Five birds took beneficial insects, 12 neutral and 21 injurious. Three birds took spiders, 1 a snail, and 1 vegetable matter.

Field Notes.

The hoopoes are usually to be found in the neighbourhood of towns and villages, and in and around cultivated areas and waste lands as long as these are not too far from trees, or bits of jungle. They are seldom seen far out in the open. Their favourite haunts are avenues, especially if grass is growing in these, grasslands and lawns. They naturally prefer damp localities to dry ones, food being then more readily procurable. It is almost entirely insectivorous, sometimes however taking worms, which and also large

caterpillars, it is said, to throw up in the air and catch in its beak as they fall; but I have never seen this, though I have watched them feeding for hours at a time, and that on worms, as well as other food.

The insect food is obtained mostly on or from under the ground, rarely on trees, or in the air. I have on several occasions seen a hoopoe fluttering on to a rough tree stem to capture ants, and on two or three occasions to take winged termites on the wing. The main portion of its food is obtained either by probing grassland for surface caterpillars and beetle grubs, or by turning over leaves and rubbish for insects. It rarely picks them off plants.

I have seen it eating the following insects, *Anomala viridis*, *Anomala varians*, and its larvæ, *Gryllotalpa africana*, Termites, Surface caterpillars of several species—*Agrotis ypsilon*, *A. spinifera*, *etc.*,—*Opatrum* spp. and some crickets, grasshoppers, *Chrotogonus sp.*, *Tryxalis*, *etc.*, and also ants. It certainly prefers large insects to small ones. It eats worms and small snails occasionally, and one stomach I examined contained some grass blades, though these were probably taken in along with insects by mistake. It is often robbed of its prey by the King Crow and occasionally by the House Crow—(*Corvus splendens.*)

Young birds are fed almost entirely on caterpillars (probably all cutworms), grubs of *Melolonthids*, and crickets. The amount of insects fed during the day to a nest of half-grown young is extraordinary. A nest was watched one day from 6 A.M. to 7-30. In the first hour 58 visits were made by the old birds to the nest. In these visits 45 insects were almost certainly cutworms, 10 were other caterpillars and grubs (some were whitish with brown heads almost certainly the larvæ of *Anomala varians*) and three were crickets (one of these may have been a large beetle), were fed to the young, and during the second half hour, 27 larvæ and grubs. All this food was obtained from grass lawns, or under sissoo and mango trees. Only one insect was brought at each visit, and all these insects were large ones.

This nest was again watched a week later. The birds seemed more wary on this occasion and in consequence but few of the insects fed could be seen; however, what were seen consisted of the same kinds as before observed, and there is no reason to expect the food would have been altered.

The following visits were made during the morning to the nest :—

6–7 A. M.	55 visits.	
7–8 A. M.	(52 approximately).	47 were seen and I left the nest for a few minutes.
8–9 A. M.	56	
9–10A. M.	46	
10–11A. M.	35	
11–12A. M.	42	
	286	

It will therefore be seen 286 visits were made in six hours. About two visits per hour were made when apparently no insects were brought : therefore about 280 insects were fed to the young. I could not see how many young there were for certain, but I think there were four, perhaps five—*not more*. For some days after the young had flown, a party of seven hoopoes were continuously together. It is therefore probable the nest contained 5 young. Assuming there were 5, each bird ate 56 insects which is certainly a big feed for the morning only, and the old birds were apparently feeding or giving insects to the young most of the day. The remains of *S. monstrosus* have been found below the entrance to a nest.

The young are not fed in March before 6 A.M. as a rule. I, however, saw an insect brought to the nest at 4-10 A.M. on one occasion. No other visit was made till 6. It was moonlight and the insect could not be identified, probably a cutworm which could be found easily if the bird could see at that hour. The old birds each keep to their own hunting ground and on one occasion when the two happened to be hunting near each other, a quarrel arose and one bird was driven elsewhere to hunt. As a rule they perch near the nest first to look round for danger and almost always

utter a grating note on approach to nest and again on entering or leaving the nest.

I have never heard the Indian Hoopoe utter the typical 'hoop' note on the ground. Some species do so according to Evans.

Nests of hoopoes casually watched for an odd minute or so, have never shown otherwise than that the young are fed on larvæ and crickets (perhaps occasionally larvæ of grasshoppers). Mole crickets (*Gryllotalpa africana*) are undoubtedly fed, as also the Berwa—(*Schizodactylus monstrosus.*)

A young hoopoe kept for some days would eat almost any caterpillar given it. It did not touch moths, even when bodies only were fed, but took crickets readily.

Anisodactyli. (*Summary.*)

Coraciæ or Rollers number only four species, of which the Blue Jay is the only generally distributed one. It occurs throughout India, not, however, being found in the hill tracts and is replaced by *C. affinis* in the East. The Broad-billed Roller is from Burma and the eastern portion of India, while the European Roller is a winter migrant to the Punjab and the North-West.

The Rollers are almost entirely insectivorous and are beneficial.

The *Meropes* or Bee-eaters are all with one exception found on the plains, two species only being, however, of general occurrence. Their food is entirely of insects, but at present we cannot definitely state their value. Those species of which we have any records of value appear to be injurious, as they take by far more beneficial insects than injurious ones.

Halcyones or Kingfishers. Some six or seven species are recorded from the plains, others being confined to hill tracts and the Malayan region. One or two are salt water species. They feed very largely on fish, while some take a variety of insects mostly of large species, such as locusts. The only damage likely to occur from the sub-order is with the purely fish-eating species, which at

times may prove pests in any stream in which there are fish of value, and in the destruction of tadpoles. Fresh-water fish-eating propensities denote a bird to be injurious.

Bucerotes or Hornbills. One species only can be claimed as a plains species, namely, *Lophoceros birostris*. Most species are from Burma or the Malabar coast, and forest districts and the Malayan region. They are almost entirely frugivorous feeding on wild fruits of various kinds, more especially on the different varieties of *Ficus*.

Upupæ or Hoopoes are represented by two species only. The food of the Indian Hoopoe has already been discussed and both species have similar habits. The European Hoopoe summers in the Himalayas migrating to Chota Nagpur, Assam, etc., in the cold weather, while the Indian species is a generally distributed resident, not however occurring in Sind and the Western portion of the Punjab.

The Hoopoes are beneficial.

MACROCHIRES.

Cypseli.—The Swifts are all more or less gregarious, feed on insects, and convey pellets of their insect prey to their young.—Jerd. B. I., I, 170.

1075. *Tachornis batassiensis*.—Palm-Swift. Mouth all slimy, and filled with the down of some syngenesious or asclepidious plant, which they apparently catch during their flight.—Jerd. B. I., I, 18.

1078. *Chætura indica*.—Brown-necked Spine-tail. Beetles, green bugs, sand wasps, and grasshoppers.—F. I. III, 174.

Owls feed either by twilight or during the night, and live on small mammalia, especially mice, rats, and shrews, also on birds, which they sometimes surprise when sleeping, various reptiles, fishes and insects.—Jerd. B. I., I, 115.

It hunts entirely by night, not coming forth till it is quite dark, and lives on rats, mice, shrews, etc. Iuto a room after a rat.—Jerd. B. I., I, 118.

1081-1085. *Collocalia.*—"This genus contains birds generally designated Swiftlets by Indian ornithologists, some of which build the edible nests of commerce. Hume showed that in the Andamans the pure white nests are always made by one species, *C. francica*, whilst other species use extraneous substances such as grass and feathers cemented together by the inspissated saliva, and their nests are consequently less valuable, or in some kinds, not worth collecting. During the day the birds hunt about for insects." (F. I., III, 175). They usually nest in caves, in limestone formations. (Watt.)

Caprimulgi.—Night Jars. Almost universally insects captured on the wing. One species is said to live a good deal on fruit.—Jerd. B. I., I, 188. All live on insects which they capture on the wing.—Jerd. B. I., I, 192. Their food consists of insects and largely of beetles which they capture chiefly, at all events, on the wing.—F. I., III, 184. The food consists, as a rule, of insects, and especially beetles, captured in the air; but the Podargidæ are asserted to pick Phasmidæ and Cicadidæ off the trees, and even to eat fruit, as *Steatornis* does, and mice.—E. B. C. N. H., 417.

1091. *Caprimulgus asiaticus.*—Common Indian Night Jar. Enters verandahs in search of moths.—Jerd. B. I., I, 177. Various moths and insects.—Bomb. Gaz., Cutch, Vol. X, page 63, & Vol. XII, 34.

1093. *Caprimulgus macrurus.*—Horsfield's Night Jar.

Stomachs examined—

8–8–08.	2 *Catharsius sabæus.*
	1 *Onitis philemon.*
	1 *Onthophagus bonasus*
	12 *Apogonia carinata.*
	2 *Astycus lateralis.*
	5 *Tanymecus* sp.
11–10–08.	38 Coleopterous mandibles (Coprids).
	1 Hemipteron (head.)
20–10–08.	1 *Vespa orientalis.*[1]
	21 Mandibles. (Coprids and 4 Carabids).
	1 *Opatrum* sp.
	6 Forficulid claspers.
	1 Hemipteron (head.)

Summary.—Of 92 insects taken by 3 birds, 4 are beneficial, 19 injurious, and 69 neutral.

Podargi.—Frogmouths. Insectivorous.—F. I., III, 193.

1097. *Batrachostomus hodgsoni.*—Hodgson's Frogmouth. Beetles.—F. I., III, 195.

The Swifts are, for the most part, resident in hill tracts, the only two species occurring in the plains have already been noted. They are presumably beneficial.

The Night Jars are mostly found in the plains some extending into hill tracts in the North-West. Two species only (*macrurus* and *indicus*) being generally or locally distributed throughout the plains. They are usually regarded as beneficial. They may possibly be so.

The Frogmouths frequent low hill tracts not being found West of Sikkim in the North. Of the same economic importance as the Night Jars.

TROGONES.

Trogonidæ.

Trogons.

Harpactes.—The Trogon flies out from time to time in pursuit of insects, chiefly beetles, moths, or cicadas, but it will occasionally feed on insects on the ground. Indian Trogons have not been observed to eat fruit as some of the gorgeous American forms do.—F. I. III, 199. Sit on trees, darting off to catch a passing insect or to secure a tempting fruit. The Old World forms seem to prefer an insect diet.—E. B. C. N. H., 442.

1100. *H. fasciatus.*—Malabar Trogon. Various insects chiefly coleopterous. Layard says it feeds on Spiders, Mantidæ, and Coleoptera.—Jerd. B. I., I, 202. Large Moth.—B. N. H. S. J., X, 292.

1101. *H. erythrocephalus.*—Red-headed Trogon. Coleoptera chiefly.—Jerd. B. I., I, 203.

The Trogons are uncommon birds, found in forest areas. Three occur in Burma, one extending to Nepal. *H. fasciatus* is most common near the Malabar coast. Of no agricultural importance.

CUCULIDÆ.

Most feed on insects, some on fruit.—Jerd. B. I., I, 318. I, 292.

Cuculus.—Chiefly on caterpillars and soft insects.—F. I. III, 205. Chiefly of caterpillars.—Jerd. B. I., I, 321.

1104. *C. canorus.*—Cuckoo. Caterpillars, grubs, worms, soft bodied insects.—F. I. III, 207. A favourite hunting ground in a patch of dock-weeds full of hairy caterpillars.—B. N. H. S. J. XVIII, 277. In England generally regarded as beneficial, owing to the fact that it eats hairy caterpillars which other birds will not touch. The food consists of insects and their larvæ, the stomach often becoming lined with hairs of caterpillars, our cuckoo does not touch eggs.—E. B. C. N. H., 354.

1107. *C. micropterus.*—Indian Cuckoo. Chiefly on caterpillars.—Jerd. B. I., I, 326.

Stomach examined—

3-10-08.	1 *Gryllotalpa africana.*
	1 *Sphex lobatus.*
	1 Hymenopteron (segments only).
	1 *Oxycetonia albopunctata.*
	1 Melolonthid grub.
	1 *Hypsa alcifron.*

Summary.—Of 6 insects taken, 4 are injurious, 1 beneficial, and 1 neutral.

1108. *Hierococcyx sparverioides.*—Large Hawk Cuckoo. Partly at all events caterpillars.—F. I. III, 213. One specimen had fed on caterpillars entirely.—Jerd. B. I., I, 331.

1109. *H. varius.*—Common Hawk Cuckoo. On caterpillars and other soft insects and on fruits. It is very fond of the fig of the banyan and other *Fici.*—Jerd. B. I., I, 330. Partly on insects, but largely it is said on fruits and buds.—F. I. III, 214.

Stomachs examined—

3–2–07.	2 *Gryllodes melanocephalus.*
	4 *Dysdercus cingulatus.*
	3 *Lygæus* sp.
22–2–08.	3 *Schizodactylus monstrosus.*
	1 *Brachytrypes achatinus.*
12–3–08.	5 *Schizodactylus monstrosus.*
19–3–08.	2 *Chrotogonus* sp.
	6 *Opatrum* sp.
27–3–07.	2 *Schizodactylus monstrosus.*
	1 *Gryllotalpa africana.*
	3 *Camponotus compressus.*
	2 *Trox indicus.*
1–4–07.	2 *Tryxalis* sp.
	5 *Œcophylla smaragdina.*
	2 *Trox indicus.*
	3 *Dysdercus cingulatus.*
	Some *Ficus* fruit.
12–4–07.	12 *Camponotus compressus.*
	3 *Phidole malinsi ?*
	3 *Trox indicus*
	1 Remains of a Noctuid (*Ophiusa arctotænia*.)
14–4–08.	27 Hairy caterpillars (Lymantriid ?).
14–4–08.	23 Hairy caterpillars (Lymantriid ?).
	Both these last two birds were shot together; one had fed on one species of caterpillar, the other on another, probably all from sissu trees.
6–5–07.	3 *Tryxalis* sp.
	5 *Brachytrypes achatinus.*
	2 *Dysdercus cingulatus.*
	4 *Lygæus* sp.
	Apparently some *Ficus* fruit.
2–6–07.	16 *Anomala varians*, L.
	3 Elaterid grubs.
21–6–07.	1 *Anomala* (*varians ?*), L.
	2 Cutworms, *Agrotis* sp.
	1 *Dysdercus cingulatus.*
	Some *Ficus* fruit.
22–6–08.	4 *Schizodacylus monstrosus.*
	5 *Brachytrypes achatinus.*
28–6–08.	1 *Gryllotalpa africana.*
	82 Caterpillars (Arctiid ?).
	3 „ (Noctuids).
20–7–08.	11 *Anomala varians*, L.
	2 Cutworms (*Agrotis ypsilon ?*).
	Some *Ficus* fruit.
6–8–08.	1 *Gryllotalpa africana.*
	21 *Anomala varians*, L.
	1 Carabid sp.
	1 *Astycus lateralis.*

Stomachs examined—contd.

7–10–07.	3 *Myllocerus discolor.*
	6 *Astycus lateralis.*
	7 *Anomala varians*, L.

Summary.—Of 300 insects taken by 17 birds, 1 is beneficial, 253 injurious, and 46 neutral. 4 birds took Ficus fruit, 2 birds took beneficial insects, 4 neutral and 17 injurious.

1112. *Cacomantis passerinus.*—Indian Plaintive Cuckoo. Caterpillars and other soft insects. Endeavour to catch a butterfly in its feet.—Jerd. B. I., I, 334.

1114. *Penthoceryx sonnerati.*—Banded Bay Cuckoo. Caterpillars chiefly.—F. I., III, 220. Jerd. B. I., I, 327.

1115. *Chrysococcyx xanthorhynchus.*—Violet Cuckoo. Mainly caterpillars.—F. I., III, 221.

1116. *C. maculatus.*—Emerald Cuckoo. Entirely on insects (in Assam account to Mr. Cooper's on ants).—F. I., III, 223. Insects.—Jerd. B. I., I, 338.

1117. *Surniculus lugubris.*—Drongo Cuckoo. Caterpillars, and beetles with various seeds.—F. I., III, 224.

1118. *Coccystes jacobinus.*—Pied-crested Cuckoo. Insects, chiefly mantids, grasshoppers, caterpillars, etc.—Jerd. B. I., I, 340. Insects not unfrequently from the ground.—F. I., III, 226.

16–6–08.	21 *Chrotogonus* sp.
	34 *Ocinara varians*, L.
	3 *Geometrid*, L.
	5 Caterpillars ? Hypsids.
29–6–08.	17 *Chrotogonus.*
	1 *Gryllotalpa africana.*
	3 *Myllocerus* sp.
5–7–08.	1 *Tryxalis* sp.
	3 *Coccinella 7-punctata.*
	1 Weevil ?
	Intestines of ? a caterpillar.
6–9–08.	1 Cricket (wing).
	4 *Oides bipunctata.*
	23 „ larvæ ?
	16 Geometrid caterpillars.
	1 *Agrotis* sp., L.
	5 Dipterous puparia.

Summary.—Of 140 insects taken by 4 birds, 3 are beneficial, 131 injurious, and 16 neutral. 1 bird took beneficial; 4 injurious and 1 neutral insects.

I have seen the young fed by *Crateropus canorus* on caterpillars, and other insects possibly grasshoppers.

1119. *Coccystes coromandus.*—Red-winged Crested Cuckoo. On caterpillars.—F. I., III, 227.

Eudynamis.—Most frugivorous of all the *Cuculinæ.*—Jerd. B. I., I, 342.

1120. *Eudynamis honorata.*—Koel. Almost exclusively on fruit of various kinds, especially banian, pipal and other figs, and also says Mr. Blythe much on that of *Mimusops elengi*, ejecting large seeds of fruits it has eaten.—Jerd. B. I., I, 343. Entirely fruit.—F. I., III, 230. Frugivorous.—Imp. Gaz. I, 251. The Koel eats fruits only.—S. M. F. Z., 1908. Feeds on fruit.—E. B. C. N. H., 356.

10–3–07.	*Ficus.*
21–4–08.	*Ficus.*
13–5–07.	*Ficus.*
18–5–07.	Litchi fruit.
28–5–08.	Hard seeded fruit, possibly litchi.
16–6–07.	*Ficus.*
19–6–07.	Mulberry.
8–7–08.	*Ficus.*
8–7–08.	*Ficus.*
21–8–08.	*Ficus.*

The young birds as soon as they leave the nest are fed entirely by their hosts—the common crows—on Ficus fruit.

24–7–08.	*Ficus* fruit.
24–7–09.	,, ,,
29–7–08.	,, ,,
3–8–09.	,, ,,
4–8–09.	,, ,,
7–8–08.	,, ,,

Summary.—Of 15 birds examined, 12 have contained *Ficus* fruit, 1 mulberry, and 2 ? litchi.

Many feed on the ground: a few are frugivorous.—F. I., III, 127. They live mainly on insects.—Jerd. B. I., I, 345, 319. The

food consists of seeds, insects, worms, small mammals, birds, and molluscs.—E. B. C. N. H., 357.

1122. *Rhopodytes viridirostris.*—Small Green-billed Malkoha. Various large insects, grasshoppers, mantids, caterpillars, etc.—Jerd. B. I., I, 347.

1123. *R. tristis.*—Large Green-billed Malkoha. Large insects, mantids, crickets, grasshoppers and also large caterpillars.—Jerd. B. I., I, 346. Insects of all kinds.—F. I. III, 232.

1124. *R. diardi.*—Diard's Green-billed Malkoha. Insects of all kinds.—F. I. III, 233.

1126. *Phœnicophaës pyrrhocephalus.*—Red-faced Malkoha. Chiefly fruit, occasionally small insects.—F. I. III, 235. A fruit-eating species.—E. B. C. N. H., 357.

1127. *Rhamphococcyx erythrognathus.*—Coleoptera, Hemiptera and very large caterpillars.—F. I. III, 236.

1128. *Rhinortha chlorophœa.*—Raffle's Green-billed Malkoha. Insects.—F. I. III, 237.

1129. *Taccocua leschenaulti.*—Sirkeer Cuckoo. Lizards, locusts, beetles.—Jerd. B. I., I, 354. Feeds on ground chiefly on grasshoppers and other insects, such as beetles and termites (whose nests Jerdon says it is often found near), occasionally on lizards. F. I. III, 239.

Stomachs examined—

22–6–08. 1 *Opatrum* sp.
1 Coprid (? sp.).
Alimentary canal and gizzard practically empty.
Some unidentifiable matter.

Summary.—Two neutral insects taken.

1130. *Centropus sinensis.*—Common Coucal or Crow-Pheasant. It eats various large insects, centipedes, scorpions, lizards, and small snakes and also slugs and caterpillars, occasionally pilfering other birds' eggs.—Jerd. B. I., I, 349. Feeds on ground on insects and occasionally on lizards and small snakes.—F. I. III, 241.

Davison speaking of the Rain Quail (*Coturnix coromandelica*), says: "I hardly ever walked out without discovering broken eggs lying about. I suspect the Common Crow-Pheasant and a large lizard are generally the offenders.—H. M. G. B. II, 157.

Stomachs examined—

4–2–08.	8 *Tryxalis* sp.
	1 *Copris orientalis.*
	1 Centipede.
	2 Land crabs.
	4 Spiders.
	7 Shells. (Opercula of *Vivipara* or *Ampullaria* sp.).
	Leaves and much vegetable matter.
20–5–08.	15 *Brachytrypes achatinus.*
	2 *Chrotogonus* sp.
	3 *Tryxalis* sp.
	12 Grasshopper larvæ.
	4 *Œcophylla smaragdina.*
	1 *Anomala varians.*
	1 Cutworm (*Agrotis* sp. larva.)
	8 Hemiptera spp.
	7 Spiders.
23–5–08.	14 *Brachytrypes achatinus.*
	5 *Opatrum* sp.
20–7–08.	2 Grasshoppers.
	1 *Anomala viridis.*
	1 *Chlœnius* sp. Pusa No. 227.
	1 Carabid.
	11 *Astycus lateralis.*
	1 *Tanymecus* sp.
	2 Lizards' tails.
	1 Mollusc (bivalve) (*Corbicula orientalis*).
17–10–07.	2 *Chrotogonus* sp.
	5 *Camponotus compressus.*
	15 *Opatrum depressum.*
	3 Small frogs.
	Grass and leaves, &c.

Summary.—Of 113 insects taken by 5 birds, 2 are beneficial, 88 injurious, and 23 neutral. 1 bird took beneficial insects, 4 neutral and all 5 injurious.

Molluscs were taken by 2 birds, centipedes by 1, crabs by 1, spiders by 2, lizards by 1, frogs by 1 and vegetable matter by 2. Doubtfully beneficial.

1132. *Centropus andamanensis.*—Andaman Coucal. Frogs, crabs.—B. N. H. S. J. XII, 566.

1133. *C. bengalensis.*—Lesser Coucal. Grasshoppers.—F. I., III, 244.

With regard to the Cuckoos, and I here refer to the true parasitic Cuckoos—the *Cuculinæ*,—and not to the Koel or the ground Cuckoos, these are generally regarded as being beneficial, the reason being that they are the only, or almost the only, group of birds that will eat hairy caterpillars. We have many references to birds other than the Cuckoos eating hairy caterpillars, but these are exceptions and Cuckoos are the only birds that do so habitually. I have examined a considerable number of different species of birds, and in no other case have I found a bird other than a Cuckoo touch this particular kind of food. Cuckoos, therefore, being the only real bird check we have on hairy caterpillars, which are mostly defoliators, need all the protection we can give them, and should be encouraged as much as is possible. They can only be encouraged in one way, namely, by the encouragement of their hosts. This brings up an interesting, if unimportant point. The hosts of Cuckoos comprise a great number of species of birds, some few of which may possibly be injurious, but the greater proportion are almost certainly beneficial. By parasitising these birds one Cuckoo is produced instead of four or five of the species parasitised. Is the good a Cuckoo does of more economic importance than the good these other birds should have done? This we cannot decide until we know all the hosts and what they feed on, *i.e.*, their economic importance. However this may be the Cuckoo is a special check on one particular class of insect, and even if proved not to do so much good as is generally supposed, merits protection from this one cause alone. It is special checks such as these that are of the greatest importance at times, and these are the species of birds to which the economic ornithologist must pay special attention. It is one of his main objects to discriminate such species or genera of birds.

Of these true cuckoos, besides the genus *Cuculus* which contains but one species common to the plains—*Cuculus micropterus*,—we have the following:—*Hierococcyx* in which genus occurs the

Common Hawk-Cuckoo or Brain Fever bird (*H. varius*). This bird is undoubtedly beneficial. Few if any beneficial insects are taken, but the food consists almost entirely of injurious insects or those allied to them; amongst these we commonly find grasshoppers (*Chrotogonus*, *Tryxalis*, etc.), crickets (*Brachytrypes* and *Gryllotalpa*); *Schizodactylus;* larvæ of Lepidoptera both smooth and hairy; beetles especially the larvæ of and imagines of *Anomala*, and imagines of Elaterids and *Rhynchophora*, whilst *Rhynchota*, amongst which occurs the Red Cotton bug, *Dysdercus cingulatus*, form a certain proportion of their diet. Fruits of various kinds but especially of the *Fici* are also freely eaten.

Of other genera of this sub-family all references point mainly to the fact that the species eat caterpillars; *Coccystes jacobinus*, a very common species in Behar during the rains only, feeds largely on *Chrotogonus*. Species other than those mentioned above are practically confined to the hills, with the exception of *Cacomantis passerinus*.

Of the *Phœnicophainæ* the Koel *Eudynamis honorata* is entirely frugivorous and is only of economic importance in that it has the habit of depositing its eggs in the nest of the common species of Crows—*Corvus splendens* and *C. macrorhynchus*—and may thus help to limit their numbers to some extent. Few cultivated fruits are taken, its fruit diet consisting mostly of Fici. *Phœnicophaës pyrrhocephalus* is mostly a fruit eater, whilst the remaining genera contain birds that appear to be mostly insectivorous, though some take lizards, frogs, etc. Mantids appear to be the only beneficial insects included in the diet, and spiders are occasionally eaten. In this group are the Ground Cuckoos, birds that are not parasitic and whose diet is far more varied than that of the *Cuculinæ*. *Centropus sinensis* is the common plains species and may or not be beneficial. It eats any living animal matter and varies this with vegetable matter occasionally, sometimes it is said being a foul feeder.

We can regard the Cuckoos as a class as beneficial, and it is unfortunate that they are not more numerous (as far as their feeding propensities go).

PSITTACI.

Parrots.

They dwell chiefly in forests, and live on fruit, grain, or roots.—Jerd. B. I., I, 253. Most wasteful feeders and are usually great pests to grain and fruit crops.—S. M. F. Z., 1908. Paraquets do a certain amount of damage to crops.—Bengal Gaz., Monghyr, 22.

Psittaci.—Plantains, papaw, apples, figs, and tarmarinds, being varied with flowers, buds, leaves, hard palm nuts and fruits of *Platanus, Casuarina, Banksia, Cactus,* or *Capsicum.*— E. B. C. N. H., 364.

Palaeornis all species of green parrots have similar habits. All are gregarious, and feed almost exclusively on fruit and seeds. They do much damage to the crops, destroying more than they eat since they have a way of breaking off a head of corn, eating a few grains, and then attacking another head. When green parrots are plentiful the long suffering ryot sees them among the ills to which the flesh is heir to. When the crops are cut the parrots feed among the stubble, picking up the fallen grains.—Dewar, B. R., 191.

1135. *Palœornis nepalensis.*—Large Indian Paroquet. Fruits and grain.—Jerd. B. I., I, 257.

1138. *Palœornis torquatus.*—Rose-ringed Paroquet. Very destructive to most kinds of grain, as well as to fruit in gardens. Burgess says that they carry off the ears of corn to trees to devour. When grains are cut it feeds on the stubble corn fields, also on meadows picking up what seeds it can. Hunting for any tree that may be in fruit.—Jerd. B. I., I, 258.

Much damage by pilfering grain and fruit.—F. I. III, 251. Fruits and grains.—E. Bc. N. H. S., 368.

Stomachs examined—

I have examined 53 stomachs of this bird during 1907 & 1908 at various seasons

December-March.	14	These birds had fed entirely on mustard, and wheat ripe and unripe. Percentage of mustard about 75. Percentage of wheat about 25.
May.	6	Lichis. They do not apparently eat the seeds.
	6	The pulpy arils of *Cephalandra.*

July.	6	Fruit of *Cephalandra indica*.
August-September	10	Maize.
2–2–08.	1	*Ficus* and also contained a little ber (*Zizyphus jujuba*) fruit.
1–3–07.	1	
21–1–07.	1	
5–1–07.	1	Entirely *Ficus*.
12–2–08.	1	
1–5–07.	1	
10–11–07.	1	
2–2–08.	1	*Ficus* and flower of the silk-cotton.
14–2–07.	1	
5–3–07.	1	
26–6–08.	1	300 seeds (Sissoo ?).
	1	paddy grain.
	1	pea.

1139. *Palæornis cyanocephalus*.—Western Blossom-headed Paroquet.

Much damage to ripe crops, especially paddy. Fruits and grains which it picks off the standing corn, or in the stubble fields. —Jerd. B. I., I, 260.

Stomachs examined—

22–6–08.		Various *Ficus* fruits.
22–6–08.		
3–7–08.		
3–7–08.		
3–7–08.		
12–4–08.		
12–4–08.	1	Geometrid larva. *Ficus* fruit.

1141. *P. schisticeps*.—The Slaty-headed Paroquet. Favourite food is seeds of wheat, pomegranates, and apricots.—Jerd. B. I., I, 261.

1143. *P. columboides*.—The Blue-winged Paroquet. Chiefly fruits of various kinds.—Jerd. B. I., I, 262.

1145. *P. fasciatus*.—The Red-breasted Paroquet. Visits plains when rice is ripe; feeding on cowdung.—Jerd. B. I., I, 263. Devouring paddy.—B. N. H. S. J. XVII, 487.

Damage tops of mangroves in Andamans by pulling off the leaves (*Rhizophora mucronota*).—B. N. H. S. J. XVII, 240.

Loriculus feed on various fruits and flower buds, probably hunting the latter for nectar; said to be particularly fond of the

coconut palm juice, and *L. indica* the juice of the wild palm (*Caryota urens*).—F. I. III, 262.

1150. *L. vernalis.*—The Indian Loriquet. Said to suck honey from flowers.—E. B. C. N. H., 368. Fruit especially guavas.—B. N. H. S. J. XVII, 487.

Of the parrots not a single species can be termed in any way beneficial. This family includes the greatest bird pest we have in India—the Rose-ringed Paroquet (*Palæornis torquatus*). This bird occurs generally throughout India. Not only does it do immense damage by eating grain of all kinds and especially cereals such as maize, wheat, barley, paddy, etc., mustard and occasionally linseed and peas, but they destroy very much more than they require for food, and may often be seen wastefully pulling wheat heads to pieces on tree tops to which they have carried them after picking them off the plant, and eating but few of the seeds. They are also at times exceedingly destructive to fruits. Numbers of wild fruit of various kinds are taken, especially *Ficus* spp., the arils of *Cephalandra*, but a preference always seems to be shown to cultivated varieties when they are in season. They are particularly partial to mangoes, litchis, and loquats.

From a note in the "Pioneer" (4-9-08) and as stated by Mr. Sclater in Ind. Mus. Notes, Vol. II, 117-121, it is evident that there is a trade for the feathers of green paroquets; this should be encouraged as much as possible as it will do much towards limiting or reducing the numbers of a species of bird so wantonly destructive for the whole of its existence.

STRIGES.

Owls.

The Owls are entirely carnivorous, and always catch their prey. They feed mostly on small mammals, hares, rats, mice, etc., a few feed on fish, and the smaller species are to a large extent insectivorous.

The food consists of small mammals such as lemmings, rats, voles, mice; of insects, with perhaps beetles in especial, and to a

less extent of birds, reptiles, bats, worms, slugs and snails. The stronger forms even capture young fawns, rabbits, hares, large grouse and so forth. While the snowy (*Nyctea*) Screech (*Strix*), and Wood (*Syrnium*) Owls occasionally take fish, which with crabs constitute the chief diet of *Ketupa*.—E. B. C. N. H., 401.

They are as a rule nocturnal, and are almost always regarded as being beneficial, since they act as a very good check on various small rodents.

Owls are nocturnal or crepuscular and carnivorous and live for the most part on mammals, on other birds, or on reptiles, few subsist on fish, and many of the smaller kinds on insects. The indigestible portions of the food—bones, hair, scales, etc.,—are disgorged as pellets. It is not an uncommon thing to find masses of small bones in a hollow tree, thus accumulated.—F. I., III, 264.

Owls are really most valuable birds, as they feed on and keep down rodent mammals, and large injurious insects.—Steb. M. F. Z.

1152. *Strix flammea*.—Barn Owl. Rats, mice, and shrews.—Jerd. B. I., I, 118. Almost entirely on rats and mice.—F. I., III, 266. Pellets only of rats and mice.—B. N. H. S. J., XII, 569. It feeds almost exclusively on rats, mice, shrews, and other enemies of the farmer, and as an exceptional case it will take a young bird, which is usually a sparrow. It will often enter a bungalow after rats and moths, etc.—Dewar, B. P., 143. Cf. B. of A. and F. Leaflet No. 51. The White or Barn Owl.

The food consists chiefly of small rodents, though birds, bats, insects and even small fish are eaten. When this bird frequents dovecotes, it destroys the rats which prey upon the eggs and the young of pigeons, and is itself practically harmless.—E. B. C. N. H., 411.

Stomach examined—

12-9-08. Remains of two mice.

In England I have seen this bird take leverets, and young rabbits, and it is occasionally reported as having taken game birds, but it is generally acknowledged now, and rightly so, to be beneficial.

1156. *Asio otus.*—Long-eared Owl. Mice, moles, beetles.—Jerd. B. I., I, 126. Mice, insects, and small birds.—F. I. III, 271.

1157. *Asio accipitrinus.*—Short-eared Owl. Field mice. B. N. H. S. J. XI, 163. A coleopteron.—B. N. H. S. J. XIV, 534. Small mammals.—F. I. III, 272.

1160. *Syrnium indrani.*—Brown Wood-Owl. In captivity, small birds, lizards, and fish.—F. I. III, 276.

1161. *Syrnium ocellatum.*—Mottled Wood-Owl. Crabs and beetles.—B. N. H. S. J. XVII, 667. Chiefly on small mammals, rats, mice, squirrels.—F. I. III, 278. Young in captivity, lizards, grasshoppers, cockroaches.—Bombay Gaz., Cutch, Vol. X, p. 59.

1162. *Syrnium seloputo.*—Malayan Wood-Owl. Beetles.—F. I. III, 279.

Ketupa.—This genus feeds on fish, crabs, and aquatic animals chiefly.—Jerd. B. I., I, 133. Fish, crabs and insects their main diet.—E. B. C. N. H., 414. Chiefly fish and crustacea.—Imp. Gaz. I, 251.

1164. *Ketupa zeylonensis.*—The Brown Fish-Owl. Mice, lizards and birds, in captivity.—B. N. H. S. J. XI, 164. Not exclusively fish.—B. N. H. S. J. III, 224. Fish, but more on crabs; by natives asserted to kill cats.—Jerd. B. I., I, 134.

Chiefly fish and crabs, but also kills birds and small mammals at times.—F. I. 3, 282.

Fish and crabs.—Bom. Gaz., Cutch, Vol. X, p. 59.

1165. *Ketupa flavipes.*—Tawny Fish-Owl. Fish and crabs.—Jerd. B. I., I, 135.—F. I., 3, 282. Fish, swooping like a fish-eagle.—B. N. H. S. J. XVII, 969. Fish.—B. N. H. S. J. XI, 224.

1166. *Ketupa javanensis.*—Malay Fish-Owl. Feeds largely on insects, but probably eats fish and crabs as well.—F. I., 283.

Bubo.—All seem destructive to game and often to poultry.—E. B. C. N. H., 414.

1167. *Bubo ignavus.*—Eagle Owl. Game birds, hares, rabbits, and even fawns of deer, and especially it is said on crows. F.

I. 3, 285. Hares, rabbits, large game birds and rodents, being said moreover to attack Fawns.—E. B. C. N. H., 413.

1168. *Bubo bengalensis.*—Rock Horned-Owl. Rats, mice, birds, lizards, snakes, crabs, and large insects.—Jerd. B. I., I, 129. F. I. 3, 285.

Rats, lizards, and crabs: remains of a peafowl.—Bom. Gaz., Cutch, Vol. X, p. 59.

1169. *Bubo coromandus:*—Dusky Horned-Owl. Prefers bulbuls to common mynahs in captivity.—B. N. H. S. J., XII, 286.

Small mammals, frogs, lizards, etc. Anderson mentions seeing one pursue a heron.—It also kills and eats crows.—F. I., 287.

1170. *Huhua nepalensis.*—Forest Eagle-Owl. Probably on birds and mammals, and it is said to kill pheasants, hares, young deer, etc.—F. I., III, 289. Pheasants, hares, rats, snakes, and sometimes on the fawns of the Ratwa, and Gooral (Hodgson).—Jerd. B. I., I, 133.

1172. *Nyctea scandiaca.*—Snowy Owl. Lemmings, rats, mice, squirrels, hares, birds, large or small, fishes, and doubtless insects.—E. B. C. N H., 412.

Scops owls are as a rule insectivorous, occasionally eating small birds and animals.—F. I., III, 290. Mice, small birds, grasshoppers, moths, and beetles.—E. B. C. N. H., 413.

1173. *Scops giu.*—Scops Owl. Insects.—Jerd. B. I., I, 138.

1176. *Scops balli.*—Andaman Scops Owl. To a considerable extent on caterpillars.—B. N. H. S. J. XII, 570.

1178. *Scops bakkamœna.*—Collared Scops Owl. Chiefly insects; on blossoming trees for *Coleoptera.*—Jerd. B. I., I, 140.

1180. *Athene brama.*—Spotted Owlet. Captures beetles and other insects on the wing, or snatches them off a branch of a tree, and dropping on any small mouse, shrew, lizard, or insect it may spy on the ground.—Jerd. B. I., I, 142.

Lives chiefly on insects, partly on mice, shrews, lizards or small birds.—F. I., III, 303.*

* *N. B.*—The stomach-records placed under No. 1188, *Ninox obscura*, in Mr. Mason's MS. evidently belong here. See also page 20.—*T. B. F.*

1183. *Glaucidium cuculoides.*—Large Barred Owlet. Field-mice and rats (small).—B. N. H. S. J., XI, 229.

Quail (*Coturnix communis*), and large crickets.—B. N. H. S. J., XIII, 531. Partly insects, also small birds and mammals. F. I., I, 305. One eating a rat; its crop contained a mouse, and some beetles.—Jerd. B. I., 145.

Insects, lizards, worms, frogs, toads, and white-ants. I once saw an owl, possibly this species, taking grasshoppers or other large insects, at about 2 P.M., near Darbhanga in Jan. 08.

1184. *Glaucidium radiatum.*—The Jungle Owlet. Chiefly beetles. Also lizards and centipedes.—Jerd. B. I., I, 144. Small birds as well as lizards and insects.—F. I., III, 307. Swooped at a wounded tree-warbler.—Bombay Gaz., Cutch, Vol. X, p. 60.

1185. *Glaucidium castanonotum.*—Chestnut-backed Owlet. Chiefly insects and lizards, occasionally on small mammals and birds.—F. I., III, 307. Mice, birds, but largely insects.—B. N. H. S. J., X, 284.

1186. *Glaucidium brodiei.*—Collared Pigmy Owlet. Chiefly insects, mice, rats, small birds; young barbet, blue-eared barbet (*Cyanops cyanotis*), coral-billed scimitar babbler (*Pomatorhynus phayrii*). —B. N. H. S. J. ?

Young male *Pericrocotus speciosus.*—B. N. H. S. J., XIII, 568. Partly on insects, partly on birds, small mammals and according to Stoliczka, lizards, and frogs.—F. I., 3, 3, 7. Chiefly on beetles and other insects.—Jerd. B. I., 146.

1187. *Ninox scutulata.*—Brown Hawk-Owl. Insects not infrequently captured in the air, also mice, lizards, etc.—F. I., 311.

Insects, occasionally mice and reptiles.—Jerd. B. I., I, 148. Insects.—E. B. C. N. H., 408.

1188. *Ninox obscura.*—Hume's Brown Hawk Owl. Rats and mynahs.—B. N. H. S. J., XVII, 488.

Stomachs examined—*

3-3-09. 3 Coprids.
3 *Catharsius sabæus.*

* These records belong to No. 1180 (See p. 193).

Stomachs examined—contd.

12–3–09.	7 *Chrotogonus* sp.
	3 *Brachytrypes achatinus.*
12-3-09.	3 *Catharsius sabœus.*
12–3–09.	3 *Chrotogonus* sp.
"	1 *Atractomorpha crenulata.*
	1 *Gryllotalpa africana.*
8–6–08.	1 *Chrotogonus* sp.
	2 *Tryxalis* sp ?
	14 *Opatrum* sp.
	1 Coprid.
	1 Carabid ? (Head only).
8–6–08.	6 *Brachytrypes achatinus.*
10–10–08.	2 Coprids sp.
	1 *Catharsius sabœus.*
	15 *Onthophagus spinifer.*
20–10–08.	3 *Chrotogonus* sp.
	1 *Gryllotalpa africana.*

Each bird examined contained a certain amount of beetles' remains which could not be identified.

Summary.—Of 69 insects taken by 8 birds, 1 is beneficial, 40 neutral, and 28 injurious. All birds took injurious insects, 4 took neutral insects, and 1 a beneficial insect. The injurious insects are of more economic importance than the beneficial, but the stomach records are too few for any definite conclusion.

The Owls occur throughout India, being perhaps more numerous in species in forest and hill tracts. About 12 species are found in the plains. Most of the larger genera are represented in the plains, the hills, chiefly the Himalayan tracts—in Burma and in the Malayan region. They are crepuscular and nocturnal. A few of the larger species attack fawns and some of the larger mammals, but the diet of most is composed chiefly of small birds and mammals such as rats and mice, and large insects such as grasshoppers, the insects being chiefly taken by the smaller owls. A few take fish.

Damage to game and fish may occur with one or two species of owls, but taken as a group they are certainly beneficial. In forming this conclusion we have to take into account what is known of the food of the family in countries other than India. Our records and references to the food of the family are far less than would have been expected from such an interesting group of birds.

ACCIPITRES.

This Order comprises the Ospreys, Vultures, Eagles, Kites, Buzzards, Falcons and Hawks.

"Some live chiefly on living animals they catch, others content themselves with such animals as they find dead. Some of the most typical groups are spread all over the world, but there are many peculiar to the warmer regions, where there is a greater abundance of animal life, and especially a great increase in the numbers of reptiles and insects; and those also that are fitted for devouring carcases which putrify so soon as in warm climates, are only developed in these countries, and here multiply numerically to a larger extent than any of the others."—Jerd. B. I., I, 2.

Birds of prey, being essentially carnivorous, are in most cases extremely useful, either as scavengers, or in destroying small mammals, insects, and diseased or sickly birds. Some feed largely on frogs and lizards and are therefore possibly injurious, as also the fish-eating varieties. At times too some considerable damage is caused by taking poultry and even young domestic animals.

PANDIONIDÆ.

1189. *Pandion haliaëtus.*—Osprey.

A winter visitor feeding on fish.—Imp. Gaz. I., 252. "Fish."—Jerd. B. I., I, 80. F. I., III, 314. "Fish of all sizes up to its own weight."—B. N. H. S. J., X, 459. Little but fish.—E. B. C. N. H., 149. Surface swimming fish.—E. B. C. N. H., 181.

VULTURIDÆ.

"Useful." "Devouring carcases of dead animals and other offensive matter, which would otherwise in the hot regions of the world tend to increase predisposition to disease."—Jerd. B. I., I, 4. Indispensably useful in a hot climate, feeding on carcases of dead animals.

1196. *Pseudogyps bengalensis.*—Indian White-backed Vulture. Carcases; human bodies. I once shot two of these birds in order to obtain some lice from them, but did not examine their stomach.

contents. They had gorged on a human body. Carrion.—Punjab Gaz., Hissar, 20.

Neophron; animal and vegetable refuse or dung, also follows the plough and devours worms, grubs, insects, reptiles and frogs.—E. B. C. N. H., 145.

1197. *Neophron ginginianus.*—Smaller White Scavenger Vulture. Human ordure, not so often on dead animals and carrion.—Jerd. B. I., I, 12. F. I., III, 327.

Occasionally on grass lands, hunting for frogs, and large crickets. I have seen it take *Brachytrypes achatinus* on a grass lawn.

Falconidæ.

These birds fly well and take their prey on the wing, feeding on small mammals, birds, reptiles, fishes, and insects, a few of the larger kinds not disdaining carrion or garbage.—Jerd. B. I., I, 19.

Nearly all are carnivorous; a few of the smaller species being insectivorous partly or wholly, and the majority capture living prey.—F. I., III, 328. Their diet varies considerably and consists of mammals, birds, reptiles, fish, frogs, tortoises, crabs, molluscs and insects. *Aquila, Haliastur* eat carrion—while the larger forms kill fawns, monkeys, foxes, hares, and other creatures of considerable size. Buzzards keep down rabbits and hunt rats and mice as assiduously as Harriers and the Kestrel; the latter devours quantities of insects, and the so-called Honey-buzzard (*Pernis*) gains its name from its fondness for grubs of bees and wasps. Kites work havoc among poultry; the Golden Eagle and still more the Peregrine Falcon, among moor-fowl; the last two proving an advantage in Scotch deer forests, where the noisy grouse disturb the stags, but being in peril of extermination on the moor lands; yet it is questionable whether more good than harm is done by the destruction of weakly game. The Osprey and Sea-Eagle eat little but fish, though they are not alone in that habit.—E. B. C. N. H., 148-149. Several hawks are said to be very fond of Dragon-flies.—S. I. C. N. H., 424.

1199. *Gypaëtus barbatus.*—Bearded Vulture; Lammergeyer. In Africa said to feed on reptiles and tortoises, dropping them on

rocks, (Hutton)—Carrion, rarely taking off anything larger than a fowl, which it devours as it flies. (Adams)—"Preys much on marmots." (Bishop Heber)—"Children at Almora." In Europe said to take lambs, kids, young chamois, and even children; also said to hurl chamois, and even on the Himalayas, *Ovis ammon*, off the cliffs. Natives of the Himalayas say it carries away ibex, young bears, sheep and goats.—Jerd. B. I., I, 15-16.

Supposed in the Alps to live upon lambs and children, but found in the Himalayas, where it is common, to subsist upon carrion and to have a particular preference for bones.—Imp. Gaz., I, 252.

Such stories of taking children and throwing goats over precipices are now discredited. It is somewhat doubtful whether this great bird ever attacks living prey, its food consisting chiefly of bones and offal. It rarely descends on a carcase; but Hume found it feeding on human ordure. Large bones, as the old story goes, are dropped to break them.—F. I., III, 330. Swooped at young markhor.—B. N. H. S. J., XII, 343.

Carcases in parts of Spain and India; in Macedonia lambs, kids, fowls, and no doubt it occasionally kills small mammals and birds. It perhaps scares young animals over cliffs, and like *Neophron* is said to carry bones and land-tortoises up into the air, letting them drop to break them.—E. B. C. N. H., 151.

Aquila.—Eagles prey on mammals, birds, reptiles, frogs, etc., and all or nearly all feed on carrion as well. The largest of them destroy various quadrupeds, but few of them disdain food that has not been killed by themselves, and some feed greedily on carrion.—Jerd. B. I., I, 55; carrion if fairly fresh and newly born lambs.—E. B. C. N. H., 148, 160.

1200. *Aquila chrysaëtus*.—Golden Eagle. Antelopes, foxes, and wolves are hunted by this eagle when trained.—Jerd. B. I., I, 156.

Their prey consists of antelopes, wolves, foxes, fawns, lambs, hares, rabbits, marmots, geese, ducks, grouse and so forth, with carrion if sufficiently fresh.—E. B. C. N. H., 161.

Atkinson in his travels on the Amoor describes and figures a scene which he asserts he witnessed himself. Some wolves had pulled down a deer, when two Golden Eagles came down from a vast height, attacked the wolves, killed two of them, and pulled their livers out.—Jerd. B. I., I, 57.

Work havoc among moor-fowl, yet it is questionable whether more good than harm is not done by the destruction of weakly game. E. B. C. N. H., 149.

1201. *Aquila heliaca.*—Imperial Eagle. Feeds much on carrion, though it also kills small mammals, birds, and lizards for food. F. I., III, 335.

"It pounces on hares, florikins, rats, lizards, and various other mammals and birds, and in default of these will eat carrion. I have several times seen one captured in a net by a portion of the carcase of a sheep being put down as a bait." In captivity prefers raw meat to birds or animals alive or dead.—Jerd. B. I., I, 337.

1202. *Aquila bifasciata.*—Steppe Eagle. Same habits as *A. heliaca.*

1203. *Aquila vindhiana.*—Indian Tawny Eagle. Frequently carries off chickens, ducklings, and other poultry. It feeds occasionally on hares, partridges, and other game, also rats, lizards, snakes, and even insects, and will always descend to fresh carcases of sheep. It, however, habitually subsists by robbing kites, falcons, etc. I once saw a pair of 'Woklabs' kill a florikin—*Otis aurita.*—Jerd. B. I., I, 61. Small mammals, lizard, snake or frog, and shares carcases of dead bullocks with vultures. Robs Accipitrine birds, nuisance in falconry, mistaking jesses for prey.—F. I., III, 339. This bird eats anything in the way of flesh it can obtain. If the opportunity offers, it will pounce on a squirrel, a small bird, a lizard, or a frog, but it is a comparatively sluggish creature, and so robs other Raptores in preference to catching its own quarry.—Dewar, B. P., 176. *Syphcotis aurita.*—Jerd. B. I., 623. H. M., 338.

1204. *Aquila fulvescens.*—Brook's Eagle. Partly on frogs.—F. I., III, 340.

1205. *Aquila maculata.*—Large Spotted Eagle. All sorts of birds, or small animals, squirrels, rats ; also lizards and frogs.—Jerd. B. I., I, 59. Chiefly frogs in India, but occasionally on small mammals, lizards, etc. Frogs, reptiles, and grasshoppers, in addition to small mammals and birds.—E. B. C. N. H., 162.

1206. *Aquila hastata.*—Small Indian Spotted Eagle. Plunders birds' nests, and also eats the cocoons of silkworms. Mr. Frith of Mymensingh saw it pulling down the nest of *Sturnopastor contra.*—Jerd. B. I., I, 63. Frogs.—B. N. H. S. J., XIV, 174.

1207. *Hieraëtus fasciatus.*—Bonelli's Eagle. Various kinds of game, hares, jungle and spur-fowl, partridges, even on peafowl ; also on ducks, herons, and other water-fowls, *Tantalus leucolophus.* Most native falconers relate of it taking favourite hawks. He also gives an instance of pigeon-houses being devastated in the Neilgherries by this bird. Also " I have very little doubt that this Eagle could be trained to kill antelopes, fawns, and probably bustards."—Jerd. B. I., I, 69.

" Lives on mammals and birds of its own killing, and never known to touch carrion. Jerdon mentions it as particularly destructive to pigeons."—F. I., III, 344.

" It is said to disdain carrion ; it preys on small mammals and birds of all sizes. It takes game birds by preference, but when hungry will not draw the line at the crow."—Dewar *Sypheotis aurita.* H. M. G. B., 3, 338.

Wild peacocks.—B. H. S. J., X, 505. Chickens.—B. N. H. S. J., XV, 142. Bonelli's Eagle—constantly carries off wounded birds, even of the larger species (*Anser ferus*).—4 M. 9 B, III, 59.

1208. *Hieraëtus pennatus.*—Booted Eagle. Squirrels, rats, doves, pigeons, chickens, etc. Layard mentions once having seen it pounce on a bulbul, in a bush. Hunts often with kites in cantonments and villages and the blame of carrying off chickens, pigeons, etc., should rest with them rather than the kites.—Jerd. B. I., I, 64. Squirrels, rats and other small animals, doves, pigeons, etc., and poultry.—F. I., III, 345. Doves, poultry, etc.—B. N. H. S. J., 10, 505 ?

1210. *Ictinaetus malayensis.*—Black Eagle. Most destructive to small game, a reward for its destruction being offered by the Nilgiri game association.—B. N. H. S. J., XIV, 164. Largely on young eggs of birds, also occasionally feeds on reptiles.—F. I., III, 348.

Almost exclusively lives by robbing nests of young and eggs. "I dare say if it saw a young or sickly bird it might seize it," but it is not fast enough for a pheasant or a partridge. Hodgson—"It preys on pheasants as well as their eggs." "I have invariably found that eggs and nestlings alone had been its food. In three cases I found the eggs of the hill quail *Coturnix erythrorhyncha*, of *Malacoccercus*, and of some doves—*Turtur*—with nestlings, and the remains of some eggs which I did not know. I have known it also after circling several times over a small tree, alight on it and carry off the contents of a dove's nest."—Jerd. B. I., I, 66. Bat. B. N. H. S. J., X, 284. I have been told it will take Jungle-fowl.

Spizaë.us, Limnaëtus, Neopus, Nisaëtus.—The food is extremely varied, including in different cases, monkeys, bucks, lambs, goats, hares, rabbits, birds as large as bustards and geese, lizards, frogs, or even fish.—E. B. C. N. H., 160.

1211. *Spizaëtus cirrhatus.*—Crested Hawk-Eagle. Hares, partridges, young Pea-fowl, Jungle-fowl, etc.—Jerd. B. I., I, 73. To these Blanford adds squirrels, lizards, etc.—F. I., III, 351.

Very destructive to poultry.—B. N. H. S. J., XVII, 670. Fowls and chickens.—B. N. H. S. J., XV, 716.

Night-hawk.—Caprimulgidæ.—B. N. H. S. J., X, 505? Very destructive to poultry yards: it preys also on bush quail, and it has been seen pursuing green pigeons. It also attacks and kills small snakes.—Bombay Gaz., Ratnagiri, Vol. X, p. 56.

1212. *Spizaëtus limnaëtus.*—Changeable Hawk-Eagle. Koel (*Eudynamis honorata*), mynah, pigeons, chickens.—B. N. H. S. J., XII, 685. Equals No. 1211 in habits.—F. I., III, 352.

1213. *Spizaëtus nepalensis.*—Hodgson's Hawk-Eagle. Pheasants, partridges and other game birds.—Jerd. B. I., I, 74. Pheas-

ants, and on other game birds, and on hares, and other small animals.—F. I., III, 353.

1214. *Spizaëtus kelaarti*.—Legge's Hawk-Eagle. Similar to No. 1213.

Circaëtus.—This genus feeds mostly on reptiles.—Jerd. B. I., I, 74.

1216. *Circaëtus gallicus*.—Short-toed Eagle. Chiefly snakes, lizards and frogs, but will eat anything, rats, crabs, and large insects. F. I., III, 357. Chief food lizards and snakes, but it will eat anything, rats, weakly birds, crabs, frogs, centipedes and large insects ; I have seen one strike at a wounded hare, and it will occasionally carry off a wounded duck and teal. It pounces on snakes and guanos—Monitor.—Jerd. B. I., I, 77. Snakes, etc.—B. N. H. S. J., X, 505.

Snakes form its favourite food, while frogs and fish from the shallows, small mammals, birds, lizards, crabs and insects are added to its daily fare.—E. B. C. N. H., 153.

"I saw one of these fine birds attempt to carry off a cobra in the public gardens at Chilkalda : my approach drove the eagle away from the reptile, which however it had crippled completely." A. S. B. XL. (11), 107.

Spilornis.—Serpent-Eagle. On reptiles and frogs. B. N. H. S. J., X, 505.

1217. *Spilornis cheela*.—Crested Serpent-Eagle. Devastates poultry yards, even attacked a turkey.—B. N. H. S. J., XVII, 969. Fowls.—A. S. B. 29-2-240. Crabs.—B. N. H. S. J., XII, 685. Raw meat in captivity.—B. N. H. S. J., XVII, 64. Eel about a foot long. B. N. H. S. J., XVII, 670. Snakes, lizards and frogs form its chief food.—Bombay Gaz., Cutch, Vol. X, p. 56.

1220. *Butastur teesa*.—White-eyed Buzzard Eagle. Land crabs.—B. N. H. S. J., IX, 101. On telegraph poles for rats and worms.—B. N. H. S. J., XIV, 807. *Turnix pugnax*.—B. N. H. S. J., XVII, 759.

Rats, mice, lizards, small snakes, frogs, crabs, and large insects. Now and then it may manage to seize a young or sickly bird. Mr.

Burgess states he took the remains of a full-grown quail from one. It occasionally captures locusts on the wing.—Jerd. B. I., I, 93.

Feeds on small mammals, reptiles, frogs, crabs, and insects.—F. I. (2) 364.

Small mammals, lizards, frogs and crabs.—E. B. C. N. H., 167. One of the commonest birds of this family, at Pusa, and especially numerous during the hot weather and the rains. It feeds very largely on insects especially grasshoppers, and also on frogs and mice. When the flying Termites emerge, I have seen it feeding on these insects entirely; it takes them on the wing, as well as on the ground. At other times it may often be seen walking on the ground, picking up various kinds of insects and frogs. I have never seen it swoop at small birds, but it will take wounded ones; I once wounded a *Gymnorhis flavicollis;* the sparrow towered, and the *Butastur* took it as it reached the ground. It also feeds largely on frogs. I have on two occasions seen this bird take the common snake *Tropidonotus stolatus.*

5, 12-4-08.	23 *Chrotogonus* sp.
	1 Mouse.
	Portions of a lizard.
12-4-08.	15 *Chrotogonus* sp.
	1 Small frog.
	Remains of a small bird.
12-7-08.	46 *Termes obesus.*
18-7-08.	23 *Termes obesus.*
	1 *Catharsius sabæus.*
	1 Frog.
25-8-08.	1 *Anomala varians.* Larva.
	12 *Brachytrypes achatinus.*
	2 *Schizodactylus monstrosus.*
	1 *Gryllatalpa africana.*
	3 Frogs.
5-3-09.	5 *Brachytrypes achatinus.*
	3 Remains of three mice.
5-3-09.	1 Lizard.
	1 Mouse.

I have on several occasions seen it eating mice and frogs, and once a small snake.

Summary.—Of 129 insects taken by 7 birds 1 is neutral and 128 injurious, 2 took lizards, 3 frogs, 3 mice, and 1 a small bird.

1221. *Butastur liventer.*—Rufous-winged Buzzard-Eagle. Robs *Astur badius* of a lizard.—A. S. B., LXIX, 133. Snakes and crabs fresh-water—F. I. 3, 365.

Haliaëtus.—Sea Eagles. Little but fish.—E. B. C. N. H., 149.

1223. *Haliaëtus leucoryphus.*—Pallas' Fishing-Eagle. Fish, bald coots, ducks, etc.—B. N. H. S. J., X, 55. Principally on fish, but also on water birds, snakes, frogs, etc.—F. I. 3, 367. Water fowl especially bald coots, as much as on fish.—B. N. H. S. J., II, 221.

Chiefly on fish, also on turtle and snakes ; and most probably will take any other food, and often carries off a wounded duck.

The ring-tailed Eagle constantly carries off wounded birds, even the larger species (*Anser ferus*).—H. M. G. B., III, 59.

1224. *Haliaëtus leucogaster.*—White-bellied Sea-Eagle. Fish, birds and mammals, and carrion.—B. N. H. S. J., 10, 505. Snake, fish, fowls.—B. N. H. S. J. Young chickens.—B. N. H. S. J., XII, 58. Chiefly on fish and sea snakes, which it captures from the water, but it will also eat dead fish, or crabs, and it not infrequently robs the osprey of its prey. F. I., III, 369. Chiefly on sea snakes, also on fish ; on rats, crabs, and anything living it can catch, and will eat dead fish. It robs the Osprey. Jerd. B. I., I, 85. Snakes, fish, poultry.—Bombay Gaz., Cutch, Vol. X, p. 57.

1225. *Haliaëtus albicilla.*—White-tailed Sea-Eagle. Mainly on fish. F. I. 3, 369. Food consists largely of fish ; said to be very destructive to lambs ; eats carrion.—E. B. C. N. H., 163.

1226. *Polioaëtus ichthyaëtus.*—Large Grey-headed Fishing-Eagle. Chiefly fish, fresh water preferred.—F. I., III, 371. Chiefly fish but will carry off a teal, or a wounded duck and strikes at other birds.—Jerd. B. I., I, 82.

1227. *Polioaëtus humilis.*—Hodgson's Fishing-Eagle Entirely on fish, or such small reptiles and animals as may be found on river banks —B. N. H. S. J., XVII, 970. Robs fish traps. Chiefly fish.—E. B. C. N. H., 164.

Haliastur.—Garbage, small mammals, birds, lizards, frogs, crustaceans, insects and their larvæ: fish.—E. B. C. N. H., 168. Kites work havoc among poultry.—E. B. C. N. H., 148.

1228. *Haliastur indus*.—Brahminy Kite. I cannot give a better note on this bird's food than by quoting in full from Jerdon. "Mr. Smith quoted from Notes on Indian Birds, P. Z. S., 1857, 85, says :—'This bird is among the first objects which attracts the eye of a stranger, for they swarm about the shipping at Calcutta, and are useful in removing any offal which may be thrown away; but though their usual food is carrion, yet they kill fish, and not unfrequently carry of a snipe which the sportsman has levelled.' Hodgson says, it chiefly feeds on insects and quests like a *Circus*. From my own observations it certainly prefers aquatic food, and is most numerous in the vicinity of sea-shores, large rivers, tanks and rice cultivation. About large cities and towns, and where there is much shipping, it gets its chief food from garbage and offal thrown overboard, or, occasionally from what is thrown out in the streets and roads. Near large rivers or lakes it manages to pick off the surface of the water small fishes, or a prawn occasionally; but its chief food, away from towns and cantonments, is frogs, and crabs, which abound in all rice fields, and the remains of which last, picked clean, may be found so abundantly along the little bunds that divide the fields from each other. It will also eat water insects, mice, and shrews, and young or sickly birds; and many a wounded snipe I have seen carried off by the Brahminy Kite. In wooded countries I have seen it questing over the woods, and catching insects, especially large Cicadæ, and I have also seen it whip a locust off standing grain. Now and then it gives hot chase to a crow, or even to a common kite and forces them to give up some coveted piece of garbage or dead fish." "It is said sometimes to carry off young chickens and pigeons."—Jerd. B. I., I, 102-103. It abounds in ports feeding on refuse thrown overboard. It also picks small fish off the surface of water with its claws and captures frogs and crabs in paddy fields and marshes. Small birds are seldom assailed by it unless sickly or weak, but Mr. Rainey saw one kill and eat a king-fisher—*Alcedo ispida*—that had

carried off a small fish on which the kite was in the act of stooping.—F. I., III, 373. Fish, Crustacea, frogs.—B. N. H. S. J., X, 505? Termites.—B. N. H. S. J., XIV, 559. Termites flying from ground.—B. N. H. S. J., XII, 289. Carrion.—E. B. C. N. H., 148. Chiefly on fish.—Imp. Gaz., I, 253.

Stomachs examined—

13–5–07.	5 *Schizodactylus monstrosus.*
	3 *Gryllotalpa africana.*
	7 *Brachytrypes achatinus.*
	Remains of a small bird.
	3 Frogs.
12–6–08.	2 Mice.
	1 Lizard.
	3 Frogs.
10–7–08.	2 *Schizodactylus monstrosus.*
	1 *Gryllotalpa africana.*
21–8–08.	16 *Brachytrypes achatinus.*
	3 Blades of grass.
5–9–08.	2 Young chickens.
10–9–08.	2 *Atractomorpha crenulata.*
	Remains of a small bird.
3–10–07.	32 *Chrotogonus* sp.
	1 Frog.
10–10–07.	16 *Brachytrypes achatinus.*
	2 Frogs.
10–10–07.	12 *Brachytrypes achatinus.*
12–10–08.	3 *Liogryllus bimaculatus.*
	1 *Brachytrypes achatinus.*
	Feet and legs of a small bird.
	3 Worms—Nematodes (parasitic ?).
	5 Shot.

Summary.—100 injurious insects taken by 10 birds, 4 birds took 9 frogs between them; 3 took small birds; 1 a lizard; one 2 mice, and 1 young chickens.

This bird occurs more commonly during the rains, but may be seen nearly the whole year round in the neighbourhood of water. It is nearly always present during irrigation operations, and at such times feeds on all kinds of crickets, which come to the surface on being flooded out, on grasshoppers and on frogs. I have seen it on several occasions take worms and lizards and at times individuals are a great nuisance to chicken runs, taking off the young birds. I have never seen them attempt to capture wild birds. During the rains I have frequently seen Brahminy Kites waiting on trees near grassy

banks where various crickets abound. As soon as the cricket appears the kite swoops down, taking the insect in its claws during flight, and carries off the cricket, devouring it as it flies. On flat land the bird captures these insects on the ground not when in flight only.

1229. *Milvus govinda*.—Common Pariah-Kite. As is well known, kites pick up garbage of all kinds, fragments of meat and fish, and generally the refuse of man's food. They are excessively bold and fearless, and often snatching morsels off a dish *en route* from the kitchen, and even according to Adams, seizing a fragment from a man's mouth. At our seaports kites find their daily sustenance among the shipping,—snatching scraps of refuse from the surface of the water. Away from the haunts of man, some seek their reptile food over the fields and hedgerows, or with the Brahminy Kites hunt the edges of tanks, rivers, and marshes, for frogs, crabs, and fish. Now and then one will seize a chicken or wounded bird of any kind, and Mr. Blyth mentions that he once knew one to kill a full grown hen. Mr. Phillips says it will carry off parrots and chickens. The food of the kite is usually devoured on the wing, or if too large, carried to the nearest house or tree.—Jerd. B. I., I, 105-107. Female kite kills a crow to feed its young one.—Dewar B. P., 148. Chickens.—Bombay Gaz., Cutch, Vol. X, p. 58. Hawk (chil) is said to eat corpses.—Punjab Gaz., Hissar, 20.

Stomachs examined—

10-3-07.	3 *Gryllotalpa africana*.
	Various kitchen scraps.
1-4-07.	Remains of a chicken.
16-4-08.	1 Mouse.
	Kitchen scraps.
16-4-08.	6 *Chrotogonus* sp.
	5 *Brachytrypes achatinus*.
	Kitchen scraps.
16-4-08.	1 Mouse.
	3 Frogs.
	1 Lizard.
	Kitchen scraps.
4-5-09.	9 *Brachytrypes achatinus*.
	1 Mouse.
	1 Lizard.
4-5-09.	1 Mouse.

Stomachs examined—contd.

10–5–09.	15 *Brachytrypes achatinus.*
	3 *Gryllotalpa africana.*
17–5–09.	17 *Brachytrypes achatinus.*
	Some chicken bones.
6–6–08.	1 Chicken, partially digested.
	1 *Chrotogonus* sp.
	1 *Cicindela ærulenta.*
	1 *Cicindela grammophora.*
	1 *Onthophagus spinifer.*
	N. B.—These insects probably came from the stomach of the chicken.
12–7–08.	11 Frogs.
	3 *Brachytrypes achatinus.*
21–8–08.	2 Small birds.
	1 Mouse.
	1 Frog.
12–9–08.	Kitchen refuse, parts of a chicken, bones, some fat, potato scraps, etc.

Summary.—Of 65 insects taken by 13 birds, 2 are beneficial (N. B.—These were probably eaten by the chicken taken by the same bird), 62 are injurious, and 1 neutral. 1 took beneficial insects, 7 injurious, and 1 neutral. 4 birds took chickens, 2 small birds, 3 frogs, 5 mice, 2 lizards, and 5 contained refuse matter.

The food of the common kite differs little from that of the Brahminy Kite. He is, however, a far bolder bird, and haunts towns and villages to a far greater extent and therefore his food consists more of refuse and scraps than his ally. It will even knock a cigarette out of one's hand. I have seen lizards, frogs, and snakes eaten by this bird, though do not know if he ever kills the latter. He is a great nuisance to poultry, often taking the young chickens. I do not know if he habitually feeds on carrion, but have seen a kite eating a dead rat, and a dead jackal, dead mynahs, etc. Any article of food is stolen whenever possible. This kite feeds also to some extent on insects, especially crickets which appear above ground during irrigation operations, but he does not haunt such places so much as the Brahminy Kite.

1232. *Elanus cæruleus.*—Black-winged Kite. Lizards.—B. N. H. S. J., XVII, 670. Insects in grass.—B. N. H. S. J., XVII, 710. Chiefly on insects and small mammals.—F. I., III, 380. Chiefly

insects but also mice and rats, and probably young and feeble birds. Eating the carcase of a dove that had been dead some time.—Jerd. B. I., I, 113. Insects, snakes, small mammals and more rarely birds.—E. B. C. N. H., 171. I saw one of these birds once capture and eat a frog.

Circus.—Harriers. Insects, reptiles, small mammals, and young or sickly birds.—Jerd. B. I., I, 95. Mainly small mammals, but partly of birds, reptiles, fish, frogs, insects and even eggs. Hunt rats and mice.—E. B. C. N. H., 148 and 155. Hawking over every field in search of small birds and lizards, ortolan and quail being especially marked out as their quarry.—Bengal Gaz., Monghyr, 22.

1233. *Circus macrurus.*—Pale Harrier. Lizards and insects, occasionally mice and young or sickly birds.—F. I., III, 383.

Reptiles and insects, also occasionally on small mice and shrews and weak, sickly or wounded birds, especially quails.—Jerd. B. I., I, 97. Larks.—Bom. Gaz., Cutch, Vol. X, p. 58.

1234. *C. cineraceus* and 1235. *C. cyaneus* have similar habits.

1236. *C. melanoleucus.*—Pied Harrier. Chiefly snakes, lizards, frogs, insects with birds and mice.—F. I., III, 386. Frogs, mice and other small prey.—B. N. H. S. J., XVII, 970. Carrion from the beach, small mammals, birds and grasshoppers.—E. B. C. N. H., 167.

1237. *C. æruginosus.*—Marsh Harrier. Teal.—B. N. H. S. J., X, 505. Frogs, fish, insects, small and weakly birds, and eggs, and often carries off a wounded snipe or teal, or makes a meal off a wounded duck that is too heavy for it to carry away.—F. I., III, 387. Chiefly frogs, fish, and water insects, also rats, shrews, and various young or weakly birds; not infrequently carries off a wounded snipe or even a teal.—Jerd. B. I., I, 100. Larks.—Bom. Gaz., Cutch, Vol. X, p. 58.

Buteo.—Buzzards. Mammals, reptiles and insects seized on the ground.—F. I., III, 389. Frogs and lizards.—B. N. H. S. J.,

XII, 290. Insects, reptiles, young or feeble birds and small mammals.—Jerd. B. I. I, 87.

Small mammals and especially rodents, also small birds, reptiles, frogs, beetles and grasshoppers, and many game-keepers now recognise the bird's utility by protecting its breeding quarters.—E. B. C. N. H., 165.

Keep down rabbits and hunt rats and mice.—E. B. C. N. H., 148.

1239. *Buteo ferox.*—Rough-legged Buzzard. Migratory, visiting North-Western India from October to March, and very abundant in desert and semi-desert tracts, when it lives mainly on the Indian Desert Gerbille (*Gerbillus hurrianæ*). It is also very common in marshy ground and it feeds on frogs, rats, mice, lizards, and large insects.—F. I., III, 392.

1241. *B. desertorum.*—Common Buzzard. Mouse, lizard.—B. N. H. S. J., XVII, 670. Lizards, frogs, rats, shrews, and young or sickly birds.—Jerd. B. I., I, 88.

1243. *Astur palumbarius.*—Goshawk. Birds, hares, gazelles.—B. N. H. S. J., X, 505? Very destructive to pheasants and other game birds.—Jerd. B. I. Pheasants, partridges, pigeons, and other birds, and on small mammals.—F. I., III, 397.

Much esteemed for hawking in India. The baz is trained to strike the houbara bustard, kites, and neophrons, duck, and many other large water birds, as cormorants, herons, ibises, etc. It is, however, chiefly trained to catch hares. The Jura is trained to strike partridges, rock-pigeons, crows, teal, etc.—Jerd. B. I., I, 46. Small mammals and birds.—E. B. C. N. H., 156.

1244. *Astur badius.*—Shikra. General food, as Jerdon says, appears to be lizards, but it frequently seizes small birds, rats, mice and sometimes does not disdain a grasshopper. It is more commonly trained than any other Indian bird of prey, and is flown at quails, partridges, and more commonly crows.

It has been seen feeding on flying termites or white-ants. F. I., III, 339—400 F. It can be taught to strike the common

crow, small grey hornbill, crow-pheasant, young pea fowl, and small herons.—Jerd. B. I., I, 50.

Small birds.—B. N. H. S. J., X, 505. *Dicrurus ater.*—The black drongo.—B. N. H. S. J., XIV, 559. Flown at small birds.—B. N. H. S. J., XII, 290. Lizards.—A. S. B. J., 69, 115, &c.

Flown at Mynahs and small birds. *Crateropus canorus.*—A. S. B. J., 64, 729. Frogs.—E. B. C. N. H., 157. Robbed of a lizard by *Butastur liventer.*—A. S. B. LXIX, 133.

Stomachs examined—

5–5–07.	2 *Chrotogonus* sp.
	1 Small lizard.
	Remains of a mouse.
5–6–07.	1 *Gryllodes melanocephalus.*
	49 Caterpillars, obtained from a sissu tree.
25–4–08.	9 *Chrotogonus* sp.
	3 *Schizodactylus monstrosus.*
	3 Geometrid caterpillars.
	1 Small bone.
13–3–09.	2 *Chrotogonus* sp.
	2 Small snakes.
	1 Lizard.
	1 Mouse or rat ; the animal had been pulled to pieces and the tail had been eaten first, presumably, being the only portion in the gizzard.
10–4–09.	13 *Chrotogonus* sp.
	1 *Schizodactylus monstrosus.*
	1 *Gryllotalpa africana.*
15–6–09.	7 *Brachytrypes achatinus.*
	1 Small bird (Sylviid ?).

Summary.—Six birds took injurious insects totalling 91 ; 2 birds took lizards, 2 mice, 1 snake, and 1 a small bird.

1244*a*. *Astur butleri.*—Nicobar Short-toed Hawk. Lizards.—B. N. H. S. J., XII, 685.

1245. *Astur soloensis.*—Horsfield's Short-toed Hawk. Lizards and frogs.—F. I., III, 491.

1246. *Lophospizias trivirgatus.*—Crested Goshawk. Small birds and lizards.—F. I. 3., 402. Birds. Trained in Ceylon after partridges. In Ceylon robs hens' eggs.—Jerd. B. I., I, 48.

1247. *Accipiter nisus.*—Sparrow-Hawk. Chiefly on birds up to the size of a pigeon and even sand grouse.—F. I., III, 403. Birds

used chiefly for capturing partridges, quails, courier plovers—*Cursorius*, and even rock-pigeon—*Pterocles*.—Jerd. B. I., I, 52.

1248. *Accipiter virgatus*.—Besra Sparrow Hawk. Small birds but also on lizards, and insects.—F. I., III, 405. The female used for capturing partridge, quail, snipe, and doves: the male for sparrows, brahminy mynahs—*Pastor pagodarum*—and other small birds.—Jerd. B. I., I, 54.

Pernis. Bees and wasps, the combs and the young of which form the principal food of this genus.

1249. *Pernis cristatus*.—Crested Honey-Buzzard. Honey and the young of bees and wasps; but it will also eat caterpillars, ants, and any other insects, and occasionally rats and reptiles, and it is said by the natives the eggs and the young of other birds.—Jerd. B. I., I, 120. *Oriolus melanocephalus*.—Eggs and young of small birds. B. N. H. S. J. III, 758. Fond of grubs of bees and wasps.—E. B. C. N. H., 148.

Stomachs examined—

9–4–07.	2	*Chrotogonus* sp.
	24	*Camponotus compressus*.
	3	Frogs.
	1	Lizard.
8–6–08.		Remains of a small bird ? chicken.
12–8–08.	25	*Chrotogonus*.
13–6–07.	5	*Schizodactylus monstrosus*.
	7	*Brachytrypes achatinus*.
	3	Small frogs.

Summary.—Three birds out of 4 took 63 insects; of these 39 being injurious and 24 neutral; 2 took insects only.

Two Birds took frogs, 1 a lizard, and 1 a chicken.

Baza.—Feed upon the ground on chameleons, grasshoppers, and other insects.—E. B. C. N. H., 173.

1251. *Baza lophotes*.—Black-crested Baza. Insects: a lizard once found in its stomach.—F. I., 3., 410. Almost entirely insectivorous.—Jerd. B. I., I, 111. Crops full of grasshoppers, and the remains of a brightly-coloured Cicada with red underwings, found

in this forest, Momai, Assam—and so it is evident they must at times feed on insects, though I believe, I have also seen a small lizard taken from the crop.—B. N. H. S. J., XVII, 531.

1253. *Baza ceylonensis.*—Legge's Baza. Lizard.—F. I., III, 412.

Falco.—The true Falcons have been trained from time immemorial to hunt and capture various kinds of winged game and even mammals.

1254. *Falco peregrinus.*—Peregrine Falcon. Chiefly water-birds. I have seen the Bhyri strike down various water-birds, teal, duck, etc.; and on one occasion I saw a pair pursue and kill a snipe. I have often had wounded teal and snipe, and other birds carried off by them. –Jerd. B. I., I, 23. Largely feeds off duck and waders, pigeons, partridges, etc.—F. I. B., 414.

Pheasant, Imperial pigeon.—B. N. H. S. J., 12, 290. Large paroquet.—B. N. H. S. J., 17, 51. Trained to strike Egrets, Herons, Storks, Cranes,—*Grus virgo, Anastomus, Ibis papillosus, Tantalus leucocephalus*, etc., and has been known to strike down a bustard.—Jerd. B. I., I, 24. Havoc among moor-fowl.—E. B. C. N. H., 148.

Ducks, guillemots, pigeons, grouse, and partridges, varied by rabbits and so forth, yet in spite of the undoubted damage caused to game, preservers would be wise to spare a due proportion of individuals in view of their utility in killing off the more weakly and diseased birds.—E. B. C. N. H., 179.

1255. *Falco peregrinator.*—Shahin Falcon. Destroys large quantities of game, partridges, quails, etc., and it is said to be very partial to paroquets. Devouring a goat-sucker—Caprimulgidæ.—Jerd. B. I., I, 27. *Palœornis nepalensis.*—Jerd. B. I., I, 257. Partridges, quails and other birds, but especially on pigeons and paroquets—bats and goat-suckers. F. I., III, 416. Used in falconry for partridges, and florikin—*Otis aurita*—, and occasionally stone plover—*Oedicnemus crepitans*—, and jungle-fowl.- Jerd. B. I., I; and F. I., III, 415.

1256. *Falco barbarus.*—Barbary Falcon. Partridges, etc. According to Jerdon trained to take mallards, etc.—F. I., III, 14.

1257. *Falco jugger.*—Laggar Falcon. A great variety of small birds, and often snatching a chicken in the midst of a cantonment.—Jerd. B. I., I, 31. Trained for crows, paddy-birds—*Ardea bubulcus*, night herons, partridges, florikin, and even the Heron *A. cinerea.*—Jerd. B. I., I, 31. Drongo.—B. N. H. S. J., XIV, 174.?

1258. *Falco cherrug.*—Saker or Cherrug Falcon. Antelopes.—Jerd. B. I., I, 29. Feeds in the Punjab very much on the *Uromastix hardwickii*, a lizard of dry regions. It is trained for hares, gazelles, cranes, houbara—*Otis macqueeni*, herons, kites—*Milvus govinda.*—F. I., III, 421.

1260. *Falco subbuteo.*—Hobby. Small birds, larks, and not infrequently insects. One crammed with Dragon-flies.—Jerd. B. I., I, 34. Much on insects, especially Dragon-flies. F. I., III, 423. Chiefly insectivorous.—B. N. H. S. G., XIX, 505. Trained for quails, larks, hoopoes, and king crows.—F. I., III, 423. For quails and larks in Europe.—Jerd. B. I., I, 34. Insects and birds.—E. B. C. N. H, 176.

1261. *Falco severus.*—Indian Hobby. Chiefly insectivorous. B. N. H. S. J., 10, 505. Locusts or grasshoppers. B. N. H. S. J. XIV, 174. Largely perhaps chiefly on insects. F. of I., III, 424.

1262. *Erythropus amurensis.*—Eastern Red-legged Falcon. Rice fields in evenings for moths and beetles. B. N. H. S. J., XII, 61.

1263. *Æsalon regulus.*—Merlin. Small birds chiefly, formerly a favourite with Falconers. F. I., III, 427. Used to be trained for quails, larks and even snipe. -- Jerdon I, 36. Small birds chiefly.—E. B. C. N. H., 177.

1264. *Æsalon chicquera.*—Turumti or Red-headed Merlin. Grasshoppers : ants.—B. N. H. S. J., XIV, 174 ? Small birds and mice in cultivated areas.--B. N. H. S. J. ? Mainly on small birds : trained for *Coracias indica.*—F. I., III, 428.

Lark, sparrows, wagtails : chiefly on birds especially social larks (*Coryphidea calandrella*), sparrows and the small ringed plovers (*Charadrius*), also not unfrequently bats. Flown at quail,

partridges, mynahs, and especially *Coracias indica*.—Jerd. B. I., I, 37.

Tinnunculus.—Less rapacious and more insectivorous.—Jerd. B. I., I, 38.

1265. *Tinnunculus alaudarius*.—Kestrel. Smaller birds than larks : large insects, reptiles and mammals.—B. N. H. S. J., X, 505? Subsists on insects (especially locusts), lizards, frogs, mice, rarely if ever touching birds.—F. I., III, 430. Chief food is lizards, but it also eats rats and mice, insects (especially grasshoppers and locusts), rarely young or sickly birds. (Flown in Europe at larks, quails, etc.).—Jerd. B. I., I, 39. Rats and mice.—E. B. C. N. H., 148.

Small mammals and *Coleoptera* furnish most of the food, a few birds—very seldom game—lizards, frogs, worms, grasshoppers, and insect-larvæ varying the diet.—E. C. N. H., 175.

1266. *Tinnunculus cenchris*.—Lesser Kestrel. More gregarious and more insectivorous than the Kestrel.—F. I., III, 431. Mountain Pipit : known to be insectivorous and has been seen seizing insects on the wing and pulling off elytra of beetles.—Jerd. B. I., I, 140.

Microhierax (Falconets) feed on insects.—Imp. Gaz., I, 254.

1267. *Microhierax eutolmus*.—Red-legged Falconet. Small birds and insects : formerly trained for small birds.—F. I., 433.

1268. *Microhierax melanoleucus*.—White-legged Falconet. Insects on wing.—A. S. B., XLV, 67. Scimitar babbler.—B. N. H. S. J. ?

1269. *Microhierax fringillarius*.—Black-legged Falconet. On dry branch from whence it pounces on its prey, beetles, etc. B. N. H. S. J., XVII, 764. More on small birds than other members of the genus.—F. I., III, 434. Insects and birds—even as large as quails.—E. B. C. N. H., 173.

1270. *Poliohierax insignis*.—Feilden's Hawk. Chiefly insects with an occasional mouse, snake or lizard.—F. I., III, 436.

Pandionidæ.—The Osprey, a migrant, is generally distributed in suitable localities near the sea coast and backwaters throughout

India in the cold weather. Its food consists entirely of fish and it is therefore injurious.

Vulturidæ.—The Vultures, of which we have nine species, are to be met with generally throughout India. They are the most useful of scavengers.

Falconidæ.—This family comprises the Eagles, Kites, Harriers, Hawks, Buzzards and Falcons.

Of the Eagles (11 genera), most occur in the plains, those few recorded from hill tracts only being apparently rare birds. Many species haunt plains and hill tracts alike, some preferring forests, other large plains more or less open. One species only—*Haliaëtus leucogastris*—is found habitually on the coast. Most are more commonly met with in localities other than the South of the Peninsula, and some two or three species are winter visitors.

Only five species of Kites are recorded. The Brahminy and Pariah Kites are well known throughout India, the Black-winged Kite being not so commonly met with. They are exceedingly useful as scavengers and from the stomach records appear beneficial so far as their insect food is concerned. Inroads on chicken runs are probably due to individual birds only, and then especially in the breeding season. They can therefore be dealt with by the destruction of the individuals which habitually frequent poultry yards, by preventing the birds from breeding in the neighbourhood of these yards and by protecting the young chickens from attack.

The Harriers—*Circus cinerascus, æruginosus* and *macrurus*—are of general occurrence, the last being a winter visitor; *cyanevs* occurs chiefly in the North-West, being replaced in the East by *melanoleucus.*

They are generally regarded as beneficial.

Hawks.—The Goshawk is confined to the Himalayas. The "Shikra" is generally distributed, and, though some occur on the plains, most other species are more frequently found in forest and hill tracts. The Sparrow-hawk is a winter visitor to hill forest tracts only. These birds are probably mostly beneficial.

Falcons.—The Peregrine is the best known of this group, and occurs as a winter visitor, especially on the sea coast. The ' Shahin' is a resident in the more wooded tracts, and the ' Laggar ' prefers more open and cultivated localities, while the ' Cherrug ' is essentially a desert species. All these birds are well known to Falconry. Their economic importance is a much-debated and an undecided question.

Other birds worthy of mention in this family are the Hobbies, which are crepuscular in habits, and found chiefly in the Himalayas. The Merlin occurs in the North-West in winter and the Red-headed Merlin (Chiquera) occurs throughout India, as also the Kestrel. These three birds are regarded as beneficial.

For full accounts of Falconry cf. Journal, Asiatic Society.

COLUMBIDÆ.

Pigeons and Doves.

Pigeons feed on fruit and grain, never touching insect-food, though a few eat snails.—Jerd. B. I., III, 442. Fruit pigeons eat figs, palm nuts, grapes and so forth.—E. B. C. N. H., 328.

Treroninæ.—Fruit pigeons. Live on fruit, banyan and pipal.—Imp. Gaz., I, 255.

Crocopus.—Purely fruit, especially banyan and *Ficus*.—F. I., IV, 4. Green pigeons, fruit.—Jerd. B. I., I, 292.

1271. *C. phœnicopterus.*—Bengal Green Pigeon. Banyan especially.—F. I., IV, 6. *Ficus* fruit.—A. S. B., LXIX, 135.

Stomachs examined—

1907-09.	110 (Approximate) *Ficus* fruit.
3-4-07.	1 *Myllocerus discolor.*
	Ficus fruit.

I have examined over a hundred birds of this species and in only one case found an insect which was undoubtedly taken by mistake. The food consists entirely of *Ficus* spp. (*F. religiosus, F. bengalensis*, etc.). This bird descends to the ground only to drink.

1272. *C. chlorogaster.*—Southern Green Pigeon. After drinking appears to pick up small pebbles, pieces of gravel or sand.—Jerd.

B. I. III, 449. Occurs where Banyans and Pipals are ripening.—Bomb. Gaz., XII, 36; and XXIII, 67. Betul, D. G., 22; Nagpur, D. G., 20. Banyan, pipal, bair.— Bombay Gaz., Ahmedabad, IV, 83; and Broach II, 45.

Osmotreron.—Fruit eaters rarely descending to the ground.—F. I., IV.

Carpophaginæ.—Fruit pigeons. Eat vast quantities of fruit (some are very fond of mice).—E. B. C. N. H., 346. Fruit.—Imp. Gaz., I, 255.

1284. *Carpophaga ænea.*—Green Imperial Pigeon. Fruit buds of *Avicennia.* –Jerd. B. I., III, 456. Figs and other fruits.—B. N. H. S. J., XVIII, 971.

1286. *Ducula insignis.*—Hodgson's Imperial Pigeon. Fruits, buds of *Avicennia* and other plants which affect salt and brackish swamps, and also pick up salt earth.—Jerd. B. I., III, 459. *Ficus.*—B. N. H. S. J., XVII, 971.

1289. *Myristicivora bicolor.*—Pied Imperial Pigeon. Largely the mace which encloses the nut-meg.—E. B. C. N. H., 328.

1290. *Calœnas nicobarica.*—Nicobar Pigeon. Mainly on seeds on the ground.– E. B. C. N. H., 334. Seeds like prune and sunflower.—B. N. H. S. J., XII, 688.

Phabinæ.

Chalcophaps.—On the ground on seeds and fruits.—E. B. C. N. H., 339.

1291. *Chalcophaps indica.*—Bronze-winged Dove. Berries and seeds picked up from the ground.—F. I., IV, 27.

Columbinæ.—The food of the Wood-pigeon is grain, beech-mast, acorns, turnips, and tender shoots of plants. The great damage, however, done to crops, such as turnips, peas or barley, by the flocks counterbalances their economic value to a certain extent, the most typical forms being the worst of offenders.– E. B. C. N. H., 328.

1292. *Columba intermedia.*—Indian Blue Rock-pigeon. Very destructive to grain, assembling in vast flocks in the cold weather.—

Jerd. B. I., III, 469. Common in cultivated country and feeds on grain and seeds.—F. I., IV, 30. Grain, millet.—Bombay Gaz., Ahmedabad, IV, 86.

1295. *C. eversmanni.*—Eastern Stock-pigeon. Great consumer of grain. (Hamilton).—Jerd. B. I., III, 468.

Palumbinæ.—Wood-pigeons are more frugivorous and bud eaters than the ordinary pigeons and doves.—Jerd. B. I., III, 464.

Dendrotreron.—Not fruit eaters, but live on berries and seeds.—F. I., IV, 33.

1297. *D. hodgsoni.*—Speckled Wood-pigeon. Chiefly on berries.—Jerd. B. I., III, 464.

Palumbus.—Grain, acorns, buds.—F. I., IV, 34.

1298. *P. casiotis.*—Eastern Wood-pigeon, Ring-dove, Cushat: grain seeds, acorns, young shoots, etc.—F. I., IV, 45. Grain, peas, young shoots and leaves, acorns, beech-mast, etc., in woods.—Jerd. B. I., III, 465.

Alsocomus.—Fruit-eating; in forests.

1299. *A. elphinstoni.*—Nilgiri Wood-pigeon. Fruits and buds occasionally on small snails; small Bulimi.—Jerd. B. I., III, 46. Fruits, buds, and according to Jerdon snails.—F. I., IV, 36.

1302. *A. puniceus.*—Purple Wood-pigeon. Chiefly fruit of *Eugenia jambolana.*—Jerd. B. I. III, 463.

Turturinæ.—Doves mostly feed on the ground on grain, pulse and other small seeds.—Jerd. B. I., III, 475.

Turtur feed almost entirely on the ground on grain and other seeds.—F. I., IV, 40.

1304. *T. orientalis.*—Rufous Turtle-Dove. Common when paddy is ripe.—T. N. H. S. J. XI, 33.

1307. *T. suratensis.*—Spotted Dove.

Stomachs examined—

4-3-09.	96 Wheat grains.
	2 Linseed seeds.
	1 Barley grain.
	1 Rahar seed.

Stomachs examined—contd.

12–3–07.	9	Paddy grains.
	2	Small weed seeds.
20–3–07.	109	Barley grains.
24–3–08.	36	Mustard seeds.
	2	Leguminous weed seeds.
	15	Grass seeds.
28–4–08.	44	Oat grains.
	6	Wheat grains.
		Various weed seeds.
29–12–08.	31	Paddy grains.
		Various weed seeds.

These records are a few of a large number examined. Barley is a very favourite food, one crop examined containing over a hundred of these seeds alone. Wheat and oats are freely taken and also peas and rahar. Every cultivated species of mustard is taken when green and when ripe; linseed is seldom eaten, though one stomach contained over fifty per cent. of these seeds. This and the next species are the two commonest doves of the plains, and always haunt cultivated areas, as well as thin jungle. If numerous, this bird certainly does some damage to crops of various kinds, though the weed seeds eaten form by far the largest percentage of its food. It must also be noted that many of the cultivated seeds and grains taken as food are gleaned up from stubbles, ploughed lands, roads, etc., and often from self-sown plants, not from the standing crops—

1310. *T. risorius.*—Indian Ring Dove.

Stomachs examined—

12–1–08.	158	Rice grains.
	81	Mustard seeds.
	6	Peas.
	9	Various weed seeds.
3–2–07.	141	Mustard seeds.
	1	Linseed seed.
	4	Weed seeds.
3–3–08.	179	Paddy grains.
	33	Mustard seeds.
21–3–07.	16	Wheat grains.
	4	Linseed seeds.
	2	Barley grains.
	12	Weed seeds.
24–3–09.	9	Wheat grains.
	3	Paddy grains.
	3	*Panicum* sp. seeds.

Stomachs examined—contd.

	7 Mustard seeds.
	3 Rahar seeds.
12-4-08.	31 Wheat grains.
	10 Mustard seeds.
	2 Barley grains.
22-4-07.	73 Wheat grains.
	9 Barley grains.
	3 Linseed seeds.
	12 Weed seeds, various.
3-11-08.	12 Wheat grains.
	74 Weed seeds, various.
27-12-06.	94 Paddy grains.
	12 Wheat grains.
	17 Mustard seeds.

Ten or eleven other specimens examined have contained nothing but small weed seeds. What has already been noted of *T. suratensis* practically applies to this bird also. The present species is perhaps more often noticeable in waste pieces of land and seems partial to the vicinity of babul trees (*Acacia arabica*). It usually occurs in small flocks of five or six birds, while *T. suratensis* almost invariably occurs singly or in pairs. When the paddy crop becomes ripe, this bird apparently feeds entirely on this grain, and though no doubt gleaning to a certain extent does some appreciable damage. A number of specimens were examined in November, and these proved to have taken paddy only as food.

1311. *Œnopopelia tranquebarica*.—Red Turtle-Dove. In fields where grain was scattered.—B. N. H. S. J., XII, 689.

Stomachs examined—

22-6-08.	174.	Grass seeds and other vegetable matter.
22-6-08.	112.	Grass and other weeds seed.

Macropygiinæ.—Cuckoo doves. More or less frugivorous, occasionally feeding on the ground.—Jerd. B. I., III, 472.

Macropygia.—Chiefly seeds and berries, one very favourite fruit being the chilli (*Capsicum fastigiatum*), of which it consumes an enormous quantity.—(W. R. l. c. p., 215). F. I. IV, 49.

1312. *M. tusalia*.—Various fruits.—Jerd. B. I., III, 476.

1313. *M. rufipennis*.—(Davison) exclusively on Nepal chillies; small black seeds (No. 1 shot), 39. Green berries like

peas. One Long green fruit (1 " and stalk 1 "). B. N. H. S. J., XII, 690.

1315. *Geopelia striata*.—Chiefly on seeds on ground.—F. I., IV, 52.

From an economic standpoint for India we may conclude that the *Columbidæ* are of no beneficial importance whatever. They certainly afford some sort of natural food-supply as practically every species is very good for food. But few species are habitually used for that purpose. Most of them are fruit or seed eaters and therefore are not beneficial from the food standpoint, though it must also be added that few do any harm to crops.

The fruit eating pigeons seem to confine their attentions entirely or almost entirely to wild fruits, such as figs, some at times attack grapes (but I doubt if this reference applies to India), nut-megs, and some possibly take plantains.

Of other pigeons and doves few can really be regarded as important. The Indian Blue Rock-pigeon (*Columba intermedia*) and the Eastern Stock-pigeon (*C. eversmanni*) are the most notorious grain pests, and the Eastern Wood-pigeon is also said to take corn.

Doves have already been noted as likely to be pests if occurring in any great numbers, but they may be generally regarded as of no importance, in India, and in some other countries would be regarded as beneficial, seeing that the greater part of their food is obtained by gleaning in the fields after the crops are off the land.

" The pigeons are all used as articles of food, and are prized by the natives of India, who consider them specially stimulating and nourishing. The most highly appreciated by Europeans are the Green pigeons."—(Watt).

PTEROCLETES.

Pterocletes.—Sand-grouse. Feed on seeds.—A. LeM., 55. Sand-grouse live on hard seeds.—F. I., IV, 54. They feed almost entirely on hard seeds.—Jerd. B. I., III, 495. Seeds, tender shoots, bulbous grass-roots, and insects, or even of berries, peas and beans.—E. B. C. N. H., 323.

1316. *Pterocles arenarius.*—Large or Black-bellied Sand-grouse. As to food I have been often assured that they eat insects freely. I can only say that I have examined the stomachs of scores without ever finding anything in them beyond small seeds and grains of various kinds and little pieces of grass and herbs. On one or two occasions I have no doubt seen a single ant or tiny beetle, but these were, I believe, picked up by accident along with some seed or other, and swallowed involuntarily. There are always, or almost always, small stones usually quartz pebbles in the stomach.—H. M. G. B. I., I, 50. Small seeds.—F. I., IV, 55.

1317. *P. fasciatus.*—Painted Sand-grouse. In the mornings they may always be found in the scrub and amongst the grass and rocks at the bases of hills, and even in small patches of cultivation, here and there dotted about these, where they feed on grain, seeds and the like ; not at all, so far as I have observed, on insects. On the 4th of January 1868 I shot 13 brace—the crops of everyone of which I noted contained exclusively ' Moth,' a common Indian pulse.—H. M. G. B. I., I, 60.

1318. *P. lichtensteini.*—Closed-barred Sand-grouse. In the forenoon and again towards evening they forage together busily, and feed then in cultivated places in maize, indigo, and cotton fields, at threshing floors on roads frequented by caravan and in valleys where there is wild vegetation.—H. M. G. B. I., I, 66.

1320. *Pteroclurus alchata.*—Large Pin-tailed Sand-grouse. Entirely on green leaves, seeds, small pulse and grain of different kinds. The gizzards contained quantities of small stones.—H. M. G. B. I. G., 78.

1321. *P. exustus.*—Common Sand-grouse. They feed on various hard seeds, especially on those of various Alysicarpi, Desmodium, etc., as well as on grass, seed or grain.—Jerd. B. I. B., 503. At water's edge pick up fragments of sand or gravel. They live wholly on seeds, and no small seeds seem to come amiss to them. I have found millet, grass, seeds, pulses of various kinds, and all kinds of, to me, unknown seeds in their crops, but very seldom a single

insect, though I have noted two cases in which I found, in one ants, in the other small beetles amongst the seeds.—H. M. G. B. I., I, 70. Its food consists in great part of the seed of the common thistle.—Bomb. Gaz., Vol. XIX, 4—0.

1322. *P. senegallus.*—Spotted Sand-grouse. Their food is mostly seeds, but I found a good many insects mixed with these in the stomachs of those I examined, and they are, I infer, less purely vegetarians than the large Sand-grouse.—H. M. G. B. I., I, 54.

1323. *Syrrhaptes tibetanus.*—Semi-desert plains, feeding on grass, and other seeds and berries, and any young green shoots it can find.—H. M. G. B. I., I, 44.

The *Pterocletes* are by no means generally distributed throughout India. They are more or less desert haunting species and are migrants and feed on small weed seeds and can only be regarded from a sporting point of view. Agriculturally they are of no importance whatever.

GALLINÆ.

Gallinæ.—True Game birds, the Grouse, Fowls, Peacocks, Turkeys, Partridges, Quails, Guinea-fowls, Megapodes. The Gallinaceous birds form the most useful and most important members of the whole class. They scrape in the ground to procure their food. In all cases they seek their food on the ground and this consists of grain, seeds, roots, buds and insects.—Jerd. B. I., III, 488. They afford more wholesome food to man than any other orders.—Jerd. B. I., III, 490.

PHASIANIDÆ.

1324. *Pavo cristatus.*—Common Peafowl. In confinement they will destroy snakes and other reptiles, and in their wild state feed much on various insects and grubs, also on flower buds and young shoots, as well as on grain.—Jerd. B. I., III, 508. The peafowl is at times omnivorous, and land shells, insects of all kinds, worms, small lizards and even tiny frogs may be found in their crops, but by choice I think they feed on grain and tender juicy shoots of grass and flower buds, and I have scores of times examined their stomachs without finding a trace of anything else, although, had they been so minded,

animal food of all kinds abounded around them. Where numerous they do much damage to cultivation, and being excessively fond of the buds of trees, are also very destructive to young plantations. "Make sad havoc with the channa, urad (both vetches), wheat or rice"—Colonel Tickell. Mr. Reid remarks that "They live for the most part on grain when procurable, but do not object to insects, and—sorry I am to say it—snakes! Years ago—my cook took a small snake, about 8 inches long, from the stomach of one I had given him to clean." Mr. Vidal—"In the jungles and forests the Peafowl eat various fruits and berries, such as the wild fig (*Covillia glomerata*) and the Korinda (*Carissa carandus*); in the neighbourhood of cultivated ground, the crop they particularly affect is maize." Mr. Sanderson—"They feed in the grain fields bordering on jungles, and do considerable damage when the grain is nearly ripe, and they move considerable distances at different seasons, tempted by ripening crops or jungle fruits."—H. M. G. B. I. I, 84-88.

They feed on grain, buds, shoots of grass, insects, small lizards and snakes.—F. I. IV, 69. Young feed especially on white ants.—B. N. H. S. J. IV, 1. Amongst birds, peacocks and parrots are the most annoying to the cultivator.—Betoul, D. G., 1907.

1325. *Pavo muticus*.—Burmese or Japan Peafowl. Cultivation does not appear to entice it far from its leafy fastnesses.—H. M. G. B. I. I, 94.

1326. *Argusianus argus*.—Argus Pheasant. The food consists chiefly of fallen fruit which they swallow whole, especially one about the size and colour of a prune, which is very abundant in the forests in the south; but they also eat ants, slugs, and insects of various kinds.—H. M. G. B. I. I, 102. They feed on fruit and insects.—F. I. 4, 72. Vegetable matter and insects.—E. B. C. N. H., 207.

1327. *Polyplectrum chinquis*.—Grey Peacock-pheasant. Our Tenasserim specimens proved to have fed upon ants and other insects, and on hard seeds. Mr. Inglis remarks: "The Kookies snare numbers; the bait is a small red berry, of which the bird is very fond." Mr. R. A. Clark—"On the rocky faces of the 'Barak' banks there

is a tree which in the cold weather bears a fruit with seeds like those of a chilli. On these the birds feed greedily—insects and worms with this fruit form their chief food, but I have on one occasion found small land shells in the stomach of the adult male. The spring-traps are baited with a crimson seed which is obtained from a forest tree.'' Darling—'' They feed in the thick clumps on seeds, insect and shells.''—H. M. G. B. I, 106-109. It feeds like the Peafowl.—E. B. C. N. H., 208.

1328. *Gallus ferrugineus.*—Red Jungle-fowl. In travelling through a forest country many will always be found near the roads to which they resort to pick up grain from the droppings of cattle, etc.—Jerd. B. I. III, 538.

Colonel Tickell remarks—'' Like the Phasianidæ wild poultry are omnivorous.'' To a certain extent the Jungle-fowl is omnivorous, and will eat not only grass and young shoots and flower buds, and seeds and grain of all kinds, but worms and grasshoppers and beetles and small land shells, but they are preferentially graminivorous, and I have examined scores which had eaten nothing but grain. In the autumn after the millet fields have ripened they grow very fat on the grain. Captain Baldwin—'' They like to scratch about at the back of old cattle sheds, and where crops grow close to the jungle side will enter the cornfields to feed.'' Mr. Rainey—'' Their principal food in the Sunderbands is insects, especially I should say the larvæ of termites or white ants which abound there. Grass seeds also doubtless afford them some subsistence. The majority rarely have an opportunity of feeding on grain. It must, however, be admitted that those which do thus get a chance of partaking the luxuries of civilization evince the greatest partiality for them, and regularly every morning and evening make a raid on the rice fields near harvest time.''—H. M. G. B. I, 220-226. Young do not thrive on white ants only.—B. N. H. S. J. XI, 678. Leaves, seeds, insects, and especially grain.—E. B. C. N. H., 209.

1329. *Gallus lafayetti.*—Ceylon Jungle-fowl. Is attracted to the particular localities where the '' nilloo,'' the native name for some species of *Strobilanthus* growing at 5,000 feet and upwards,

is, at the time, in seed. It lives chiefly upon various kinds of wild seeds and grain and more especially on white ants. We have often seen this species enter cultivated areas in large flocks scratching and picking up the grain with great ease. Mr. Layard—" Mother leads them "—the young—" to decaying prostrate trees and scratches for white ants which they eagerly devour. Captain W. V. Legge—" At times when the nilloo, a plant whose seed the Jungle-fowl greatly affects, is in flower great numbers resort to the jungles of the upper hills of the Nuwara Eliya district. My friend informs me that they were so numerous and apparently so stupefied that.—H. M. G. B. I, 245.

1330. *Gallus sonnerati.*—Grey Jungle-fowl. It feeds on various kinds of grain and very much on insects, especially on various kinds of bugs, larvæ of small Blattæ, etc.—Jerd. B. I. III, 543. Davison says : " When a tract of bamboo comes into seed, or any other particular food is locally abundant, they collect there in vast numbers dispersing again as soon as the food is consumed. I remember on one occasion when the undergrowth of the Sholas about Puykarra (which consists almost entirely of *Strobilanthus sp.*) seeded the jungle-fowl congregated there in the greatest numbers, I mean by hundreds, and were excessively numerous for more than a fortnight, when they gradually dispersed, owing I believe, not so much to the seeds having all been eaten, as to what remained of them having sprouted and so become uneatable—as for food they seem to eat almost anything ; grain, grass, seeds, grubs, small fruits and berries and insects of different kinds. I have sometimes killed them with nothing but millet in their crops ; at other times quantities of grass seeds or again after the grass has been recently burnt the tender juicy shoots of new grass."—H. M. G. B. I. I, 233-236.

1333. *Catreus wallichi.*—Cheer Pheasant. " The Cheer pheasant feeds chiefly on roots for which it digs holes in the ground ; grubs, insects, seeds, and berries and if near cultivated fields, several kinds of grain form a portion ; it does not eat grass or leaves like all the rest of our pheasants.—Jerd. B. I. III, 530. Hume and Marshall quote Jerdon.—H. M. G. B. I. I, 174. This pheasant feeds

on roots which it digs up, grubs, insects, seeds and berries, etc.—F. I. IV, 84.—E. B. C. N. H., 212.

1334. *Pucrasia macrolopha.*—Koklas or Pukras Pheasant. The koklas feed principally on seeds and buds ; it also eats roots, grubs, acorns, seeds, and berries and moss and flowers. It will not readily eat grain.—Jerd. B. I. III, 526.

Hume and Marshall quote Wilson in Jerdon B. I., as above and add—Captain Baldwin: "It is in the habit of hunting for food and scratching about in search of insects among Rhododendrons."—H. M. G. B. I. I, 162. It lives chiefly on leaves and buds, but it also feeds on seeds, berries, fruit and insects.—F. I. IV, 87.

1335. *Lophura rufa.*—Vieillot's Fire-backed Pheasant. Davison: "They never come into the open, but confine themselves to the forests, feeding on berries, tender leaves and insects and grubs of all kinds, and they are very fond of scratching about after the manner of domestic poultry and dusting themselves."—H. M. G. B. I. I, 213.

1336. *Gennæus albicristatus.*—White-crested Kalij Pheasant. It feeds on roots, grubs, insects, seeds and berries, and the leaves and shoots of shrubs.—Jerd. B. I. III, 534.

On frequented roads—to which horse-dung and droppings of other beasts containing undigested grain attracts them. Wilson: "It feeds on roots, grubs, insects, seeds and berries, and the leaves and shoots of plants"—though Wilson does not notice it, they feed greedily on grain.—H. M. G. B. I. I, 178-181.

1338. *Gennæus melanonotus.*—Black-backed Kalij Pheasant. The food of the Kalij is varied in the extreme. It eats almost everything, in the shape of seeds, fruit and insects, but is particularly fond of the larvæ of beetles out of cowdung and decayed wood, and of several of the jungle yams which bear tubers along their vines at the axils of the leaves. When the vine borne tubers are exhausted, it will scratch away the soil to get at those under ground. Natives who have kept them alive say they thrive excellently on yams and grubs only, but that no insects come amiss to them except ants.

It is also very partial to all kinds of grain from the fields adjoining its cover, seeds of the *Erythrina* and Cucurbitous plants, the young tops of several nettles and ferns and the fruits of numerous plants especially of the totney (*Polygonum molle*) and the yellow raspberry (*Rubus flavus*), two shrubs which yield more bird food in Sikkim than do any other dozen kinds of plants put together. Gammie Colonel Tickell says : " Hill pheasants are sure to be met with on mountain paths—picking and scratching about the dung scattered on the road." H. M. G. B. I. I, 192-193.

1339. *G. horsfieldi.*—Black-breasted Kalij Pheasant. Inglis " Their food consists of wild berries or fruits, beetles or other insects. Mr. R. A. Clark says : " I once witnessed a fight between a male Kalij and a jungle cock (*G. ferrugineus*) for the possession of a white ant hill from which the winged termites were issuing." Mr. Cripps writes : " Their food find consists of berries, grain extracted from the droppings of horses, all kinds of tender shoots, and worms."—H. M. G. B. I. I, 197-199.

1340. *G. lineatus.*—Burmese Silver Pheasant. It is almost omnivorous and feeds according to season and locality on all kinds of insects, grain, seeds, small jungle fruits and berries, and certain young leaves, green shoots and flower buds. Captain Fielden : " These birds feed a great deal on the young shoots of a kind of *Orchis* which rather resembles a large Roselle flower, and its juicy leaves enable these pheasants to live for some time far away from water." Mr. Oates remarks : " Their food is very varied. Ants both black and white are eagerly sought after ; the former are an especial weakness of our bird, and the only food on which it thrives in captivity. During the hot weather pheasants eat the fig of the pipal ravenously ; and I have shot birds with nothing but this food in the stomach." Davison notes—" Their food consists of grain seeds of various kinds, young leaves and grass, grubs and insects."—H. M. G. B. I. I, 205-208.

1342. *Lophophorus refulgens.*—Monaul. Mr. F. Wilson : " In autumn they resort to those parts of the forests where the ground

is thickly covered with decayed leaves under which they search for grubs. In autumn the Monaul feeds chiefly on a grub or maggot which it finds under decayed leaves ; at other times on roots, leaves and young shoots of various shrubs and grasses, acorns, and other seeds and berries. In winter it often feeds in the wheat and barley fields, but does not touch the grain ; roots and maggots seem to be its sole inducement for digging amongst it.—Jerd. B. I. III, 511-514 ; H. M. G. B. I. I, 126-128. It lives on insects, seeds, berries, leaves, etc.—F. I. IV, 97. Roots, grain, fruit, grass, and insect larvæ.—E. B. C. N. H., 216.

Tragopan.—Horned Pheasants. Grubs, insects, roots, flowers, fruits, and especially seeds or herbage.—E. B. C. N. H., 217.

1344. *Tragopan satyra.*—Crimson Horned Pheasant. To judge from those I have examined they feed much on insects, young green shoots of bamboo, and on some onion-like bulbs, but Mr. Hodgson notes that those he examined had fed on wild fruits, rhododendron seeds, and in some cases entirely on aromatic leaves, bastard cinnamon, daphne, etc.—H. M. G. B. I. I, 138.

1345. *T. melanocephalus.*—Western Horned Pheasant. Wilson (Mountaineer) : " It feeds chiefly on the leaves of trees and shrubs ; of the former the box and oak are the principal ones, of the latter, ringall and a shrub something like privet. It also eats roots, flowers, grubs, and insects, acorns, and seeds and berries of all kinds, but in a small proportion compared with leaves. In confinement it will eat almost any kind of food."—Jerd. B. I. III, 521. Mr. Young in Kullu : " Its favourite food is the berry of an evergreen plant called in Kullu Dekha ; it is I believe a species of *Carunda.*" Wilson (Mountaineer) also quoted cf. Jerdon. B. I. H. M. G. B. I. I, 127. This Horned Pheasant is a forest bird feeding chiefly on leaves of trees and bamboos.—F. I. IV, 101.

1346. *T. blythi.*—Grey-bellied Horned Pheasant. Mr. G. Dammant : " Two live examples—eat worms and a kind of red berry very greedily."—H. M. G. B. I. I, 132. The food it is said to consist chiefly of berries.—F. I. IV, 100.

Ithagenes.—Blood Pheasants. Grass, insects, berries and shoots of juniper or pine.—E. B. C. N. H., 218. The principal food consists of tops of pine and juniper in spring, berries, mosses, and bamboo leaves in winter.—A. C. M., 89.

1347. *Ithagenes cruentus.*—Blood Pheasant. Dr. Hooker: "The principal food of the bird consisting of the tops of the pine and juniper in spring, and the berries of the latter in autumn and winter, its flesh has always a strong flavour."—Jerd. B. I. III, 523. Mr. Hodgson: "They greatly affect the clumps of mountain bamboo and feed about on ground amongst these much like domestic fowls, turning over the leaves and grasses with their feet, scratching about in the ground and picking up insects, grass seeds, grain and wild fruits." Dr. Hooker is also quoted. Dr. Jerdon: "The food of those examined consisted entirely of vegetable matter." Mr. W. Blandford: "In their crops I found small fruits, leaves, seeds, and in one instance what appeared to me to be the spore cases of a moss; there were no leaves or berries of juniper, and the birds were excellent eating.—H. M. G. B. I. I, 155-157.

It is said by Hooker to feed on the tops of pine and juniper and the berries of the latter, but those killed by me in September had fed on various leaves, seeds, small fruits, etc., not on conifers.—F. I. XXIV, 104.

Perdicinæ.—The food consists of grain, insects and their larvæ.—E. B. C. N. H., 218.

1348. *Ophrysia superciliosa.*—Mountain Quail. Captain Hutton: "Amongst the long grass—feeding on the fallen seeds." They feed on grass seeds (and probably insects and berries).—H. M. G. B. II, 106-107. Hutton and others "Seeds of grass."—F. I. IV, 106.

1349. *Galloperdix spadicea.*—Red Spur-fowl. It feeds on various kinds of grain, and very much on insects, especially on various kinds of bugs, larvæ of small Blattæ, etc.—Jerd. B. I. III, 543. Their food consists chiefly, according to my experience, of grain and seeds of all kinds, and small jungle fruit, the berries of the dwarf *Zizy-*

phus (Jharberi), the figs of the pipal and its congeners, but I have often found the remains of bugs, beetles, and other insects in their crops mixed with these.—H. M. G. B. I, 239. Its food consists of small fruit, seeds and insects.—F. I. IV, 108.

1350. *G. bicalcarata.*—Ceylon Spur-fowl. Mr. Hara: "They feed on various kinds of grain, but perhaps chiefly on white ants and various other insects and their larvæ."—H. M. G. B. I, 262.

1352. *Bambusicola fytchii.*—Western Bamboo-Partridge. Feed habitually on the ground on grass seeds, berries and insects.—H. M. G. B. II, 97.

1353. *Rollulus roulroul.*—Green Wood-Quail. Dense forest, feeding on berries, seeds, tender shoots and leaves, and insects of various sorts.—H. M. G. M. III, 103. Berries, seeds, tender shoots, leaves and insects.—F. I. IV, 112. Seeds, berries, and insects.—E. B. C. N. H., 221.

1354. *Excalfactoria chinensis.*—Blue-breasted Quail. They feed chiefly on grass seeds; very little so far as my experience goes, on either grain or insects, though they do undoubtedly eat both of these. But I have always found them in meadows, where there was but little cultivation in the neighbourhood, and perhaps, when they occur where millet fields are common, they may as I have been told, feed equally on these small grains. Davison: "Those that I have examined—and I have lately dissected numbers—had eaten only grass seeds."—H. M. G. B. II, 164. Its food consists chiefly of grass seeds.—F. I. IV, 114. Mainly upon seeds.—E. B. C. N. H., 219.

Coturnix.—True Quails. The food consists of seeds, slugs and insects.—E. B. C. N. H., 221.

1355. *Coturnix communis.*—Common or Grey Quail. It is found in long grass, cornfields, stubble and fields of pulse, wandering about according as the crops ripen in different parts of the country. Hodgson states that they reach the valley of Nepal, in greatest numbers, at the ripening of the autumn and spring crops respectively.—Jerd. B. I. III, 588.

When they are in season the millets are I think their chief food ; but they eat all kinds of grain grass, seeds, small fruit like those of the Jharberi, and all kinds of small insects especially beetles, bugs and ants. *Coturnix*, Colonel Tickell—" It adheres to the paddy-fields after the crops are cut, gleaning in stubble for grains left by the reapers, and when these are exhausted, repairs to the fields of pulse, vetch, etc. (urhur, channa, moong, oorud, etc)., which are about that time ripe, and feeds on the peas that fall from the pods."—H. M. G. B. II, 137, 140.

1356. *C. coromandelica.*—Black-breasted or Rain-Quail. Both this and the grey-quail are very partial to the grains of Cheenee, a small millet cultivated extensively in Bengal during the hot weather and the rains.—Jerd. B. I. III, 590.

Their habits too are very similar, but the present species, on the whole, is more of a grass bird than the grey-quail, and feeds more on grass seeds ; and though of course found often in millet and other crops, is less exclusively devoted to these, and feeds less on grain than its cosmopolitan congener. Their chief staple of food is, I think, grass seeds, but they eat also all kinds of grain and lentils, and many insects, especially termites. I remember shooting one that had eaten several of the scarlet velvet mite (*Trombidium tinctorum* or some such name) that appears so commonly at the commencement of the rains, a thing that rather startled me, as I have noticed that birds generally avoid these gorgeous morsels.—H. M. G. B. II, 152-153.

Perdicula.—Bush Quails. Seeds and insects.—E. B. C. N. H., 223.

1357. *Perdicula asiatica.*—Jungle Bush-Quail. Feeding on grain dropped by cattle.—Jerd. B. I. III, 582. Their chief food appears to be grass seeds and grains of millets. Ragi stubble is a sure find for them ; but they eat any small seeds and grains, and sometimes you find quantities of insects, ants and tiny coleoptera in their crops. I am disposed, however, to think that they only eat these latter when grain and seeds are scarce, for in numbers that

I have examined nothing absolutely, but these latter were to be noticed.—H. M. G. B. II, 118.

1358. *P. argunda.*—Rock Bush-Quail. As regards food, I have never detected any difference between the two species.—H. M. G. B. II, 118.

Microperdix.—Bush-Quails. Seeds and insects.—E. B. C. N. H., 223.

1359. *Microperdix erythrorhynchus.*—Painted Bush-Quail. Seeds and insects.—Jerd. B. I. III, 585. Rocky ground, interspersed with bushes, etc., near cultivation, or any road along which cattle, carrying grain, habitually pass. Miss M. Cockburn says : " These Quails feed on small grain and insects." They feed very greedily on the lesser millets, and when they can get any of these like the " Sawan " (*Panicum miliaceum*), they feed on them exclusively, but at other times no small seeds or insects come amiss to them.—H. M. G. B., 2123-2126.

1360. *Microperdix blewitti.*—Blewitt's Bush-Quail. Seeds of sorts and insects. (F. R. Blewitt).—H. M. G. B. II, 130.

Arboricola.—They feed on seeds and insects and drink daily.—F. I. IV, 124. The food consists of leaves, roots, berries, seeds, grubs and molluscs.—E. B. C. N. H., 222.

1362. *A. torqueola.*—Common Hill-Partridge. Its food is very similar to that of the Coklass pheasant. It feeds on leaves, roots, maggots, seeds and berries ; in confinement it will eat grain.—Jerd. B. I. III, 578.

1363. *A. rufigularis.*—Blythe's Hill-Partridge. Food precisely like that of the common species (*torqueolus*). Davison " They feed on insects, small land shells, fallen berries and various seeds, and are very fond of scratching about among the dead leaves."—H. M. G. B. II, 76-77.

1365. *A. atrigularis.*—White-cheeked Hill-Partridge. Mr. Cripps—" They feed on insects for which they scratch amongst the

decaying leaves that carpet the ground, seeds and berries of various kinds, and on young shoots.—H. M. G. B., 2, 80.

1367. *A. brunneipectus.*—Brown-breasted Hill-Partridge. Mr. Darling—"They feed amongst the dead leaves on seeds, insects and small shells." Colonel Tickell—"Amongst the fallen leaves and elephant's droppings for the insects that congregate in such spots." Mr. Oates—"Their food appears to consist of hard seeds, but in one instance I found a beetle in the stomach of one of them."—H. M. G. B., 2, 87-88.

1368. *Tropicoperdix chloropus.*—Green-legged Hill-Partridge. "Scratching about the elephant's dung and turning over the dead leaves for insects."—Colonel Tickell. Mr. Davison—"Scratching among the dead leaves for insects and seeds."—H. M. G. B., 2, 91-92.

1369. *Caloperdix oculea.*—Ferruginous Wood-Partridge. Insects, seeds and berries.—H. M. G. B., 2, 102; E. B. C. N. H., 221.

Caccabis.—The food consists of leaves, fruits, seeds and insects.—E. B. C. N. H., 229.

1370. *Caccabis chucar.*—Chukor. Gleaning at first—mid September—in the grain fields which have been reaped, and afterwards, during winter, in those which have been sown with wheat and barley for the ensuing season, preferring the wheat. The Chuckore feeds on grain, roots, seeds and berries. Mountaineer. Jerd. B. I., 3, 565.—H. M. G. B., 3, 37-38. At times does some little damage by pulling grain stacks about in the fields.

1371. *Ammoperdix bonhami.*—Seesee. Their food is, I think, chiefly, if not exclusively, grain, seeds and herbage of different kinds. My impression is that they are not insectivorous.—H. M. G. B., 2, 46.

Francolinus—The diet consists of insects, shoots of plants, berries, seeds and bulbs.—E. B. C. N. H., 227.

1372. *Francolinus vulgaris.*—Black Partridge. Insects of all sorts—larvæ, white ants and their eggs, small coleoptera, grain and

seeds of all kinds, and tender shoots of grass, mustard and many sorts of herbage. When in the neighbourhood of villages I fear that, though not so utterly depraved as the Grey Partridges, they are yet by no means scrupulously clean feeders.—H. M. G. B. I., 2, 12.

Stomachs examined—

27–2–07.	3	*Œcophylla smaragdina.*
	6	*Camponotus compressus.*
	2	*Opatrum depressum.*
	1	*Scleron orientale.*
	6	Oats.
	108	Leguminous seeds (No. 5).
30–2–08.	9	*Camponotus compressus.*
	12	*Opatrum* sp.
	2	*Mesomorpha villiger.*
	12	Oats.
	9	Wheat grains.
	94	Seeds (No. 16).
	17	Leguminous seeds (No. 5).
20–3–08.	1	Coprid sp.
	2	Spiders.
	10	Oats.
	73	Seeds (No. 16).
	51	Leguminous seeds (No. 5).
28–3–07.	12	*Camponotus compressus.*
	5	*Œcophylla smaragdina.*
	2	*Polyrachis simplex.*
	3	*Himatismus* sp.
	13	Wheat grains.
	14	Oats.
	91	Seeds (No. 16).
	14	Leguminous seeds (No. 5).
30–3–08.	19	*Camponotus compressus.*
	1	*Mesomorpha villiger.*
	3	Small stones.
	21	Oats.
	8	Leguminous seeds (No. 4).
16–4–09.	1	*Gastromargus* sp.
	49	Leguminous seeds (No. 5).
	20	Seeds (No. 15).
	51	Leguminous seeds various.
18–4–09.	2	*Gastromargus* sp.
	1	*Œcophylla smaragdina.*
	21	Wheat grains.
	4	Leguminous seeds (No. 2).
	1	Seed (No. 12).
	1	Leguminous seed (No. 5).
	1	Large piece of grass, much half digested matter mostly buds and seeds :—all vegetable.
18–.–09.	31	Oats.

Stomachs examined—contd.

335 Seeds (No. 16).
36 Leguminous seeds (No. 5).
18-4-09. 1 Grasshopper. (Jaw only.)
2 *Brachytrypes achatinus.*
2 *Œcophylla smaragdina.*
1 *Hister opacus.*
1 *Hister bipustulata.*
11 *Himatismus* sp.
1 *Opatrum depressum.*
3 „ sp.
1 *Cicindelid* (head).
1 *Cydnus nigritus.*
1 Leguminous seed (No. 8).
94 Leguminous seeds (No. 5).
31 Seeds (No. 16).
18-4-09. 1 *Sphex lobatus.*
1 *Chrysis* sp.
31 *Camponotus compressus.*
23 *Œcophylla smaragdina.*
6 *Himatismus* sp.
4 *Myllocerus blandus.*
1 „ *discolor.*
93 Leguminous seeds (No. 5).
15 „ seeds (Nos. 9, 18, 28).
1 Stone.
18-4-09. 14 *Camponotus compressus.*
7 *Myllocerus discolor.*
5 „ *blandus.*
1 *Himatismus* sp.
1 *Melolonthid* sp.
1 Small caterpillar.
2 *Cydnus nigritus.*
15 Oats.
13 Leguminous seeds (Nos. 7, 8, 21, 28)
43 „ seeds (No. 5).
94 Seeds (No. 16).
1 Piece of red brick.
18-4-09. 43 *Camponotus compressus.*
4 *Œcophylla smaragdina.*
3 *Polyrachis simplex.*
1 Small Elaterid sp.
1 *Agrotis segetis* (Larva).
6 Oats.
1 Wheat grain.
5 Leguminous seeds (No. 5).
9 Seeds (No. 16).
1 Seed of *Abrus precatorius.*
18-4-09. 1 Grasshopper sp.
4 *Œcophylla smaragdina.*
17 *Myrmecocystus setipes.*
12 *Himatismus* sp.

Stomachs examined—contd.

3 *Opatrum* sp.
10 Oats.
39 Leguminous seeds (No. 5).
163 Seeds (No. 16).
6 Leguminous seeds (Nos. 3, 4, 18).
5 Bits of stick.

18-4-09.
6 *Camponotus compressus.*
5 *Acantholepis frauenfeldi* var *bipartita.*
1 *Himatismus.*
1 *Hister opacus.*
2 ,, *bipustulatus.*
4 *Myllocerus blandus.*
9 ,, *discolor.*
1 *Lamellicorn.*
12 Oats.
29 Leguminous seeds (No. 5).
61 Seeds (No. 16).
2 Seeds (No. 13).

18-4-09.
2 *Brachytrypes achatinus.*
1 *Myrmeleo* larva.
1 *Pompilus subsericeus.*
1 *Mutilla discreta.*
7 *Myrmecocystus setipes.*
5 *Phidole malinsi ?*
1 *Polyrachis simplex.*
4 *Acantholepis frauenfeldi* var *bipartita.*
15 *Camponotus compressus.*
5 *Œcophylla smaragdina.*
2 *Trox indicus* (?)
31 *Himatismus* sp.
1 *Opatrum depressum.*
1 *Opatrum* sp. (Pusa No. 2499).
2 *Opatrum* sp. (Pusa No. 2440).
2 *Mesomorpha villiger.*
1 *Scleron orientale.*
1 Elaterid.
1 *Bolboceras catanus.*
1 *Caccobius vulcanus.*
1 *Gymnopleurus miliaris.*
1 *Onthophagus bonasus.*
3 *Myllocerus blandus.*
3 ,, *discolor.*
1 *Nezara viridula.*
10 *Cydnus nigritus.*
3 ,, *varians.*
16 ,, sp. (Pusa No. 543).
2 *Geotomus pygmœus.*
1 *Homœocerus inornatus.*
2 *Graptostethus servus.*
1 ,, *dixoni.*
1 *Storthecoris nigriceps.*

Stomachs examined—contd.

16 *Dermatinus lugubris.*
1 Membracid.
18 Jassids.
2 Grubs.
2 *Diptera,* pupæ.
1 Spider.
6 Wheat grains.
55 Oat grains.
7 Leguminous seeds (Nos. 3, 4, 19).
52 Seeds (No. 16).
77 Leguminous seeds (No. 5).
3 Seeds (No. 23).
1 Seed (No. 12).
1 Small piece of quartz.
1 „ „ „ brick.

18–4–09. 19 *Œcophylla smaragdina.*
13 *Camponotus compressus.*
13 *Himatismus* sp.
2 *Trox indicus.*
1 *Macrochilus 3-pustulatus.* (Carabid).
1 Leptid fly.
10 *Cydnus nigritus.*
4 *Cydnus* sp. (Pusa No. 543).
45 Oats.
161 Leguminous seeds (No. 5).
4 Seeds (No. 16).
1 Green glass bead.
1 Shot.

23–4–08. 1 *Acridium æruginosum.*
9 *Camponotus compressus.*
4 *Meranoplus bicolor.*
5 *Polyrachis simplex.*
1 *Mesomorpha villiger.*
2 *Aphodius marginellus.*
54 Oats.
63 Leguminous seeds (No. 5).
93 Seeds (No. 16).
3 Various seeds.
4 Bits of brick.

23–4–08. 15 *Camponotus compressus.*
14 Oats.
18 Leguminous seeds (No. 5).
24 Seeds (No. 16).
1 Seed (No. 22).
5 Bits of red brick.
1 Green glass bead.

25–4–09. 21 *Camponotus compressus.*
7 *Himatismus* sp.
7 Oats.
11 Leguminous seeds (No. 5).
19 Seeds (No. 16).

Stomachs examined—contd.

	5	Stones and bits of brick.
25-4-09.	20	*Camponotus compressus.*
	3	*Myrmecocystus setipes.*
	1	*Cremastogaster subnuda.*
	1	*Opatrum mesonotum.*
	8	*Mesomorpha villiger.*
	5	*Himatismus* sp.
	1	*Monophlebus octocaudata.*
	1	*Clavigralla horrens.*
	8	Oat grains.
	20	Leguminous seeds (No. 5).
	63	Seeds (No. 16).
	14	Leguminous seeds (Nos. 3, 7, 9, 20).
	3	Seeds (No. 14).
	57	*Panicum* sp. seeds (No. 10).
	1	Seed (No 24).
	1	Small stone.
	2	Pieces of brick considerable amount of sand
5-4-09.	15	*Camponotus compressus.*
	15	*Mesomorpha villiger.*
	2	*Sphenoptera gossypii.*
	6	*Himatismus* sp.
	2	*Gymnopleurus parvus.*
	6	*Onthophagus dama.*
	1	Weevil sp.
	1	Cutworm (*Agrotis* sp.).
	20	Oats.
	11	Leguminous seeds (No. 5).
	12	Seeds (No. 16).
		A few buds.
	5	Shot.
25-4-09.	6	*Camponotus compressus.*
	2	*Ecophylla smaragdina.*
	10	*Mesomorpha villiger.*
	4	*Himatismus* sp.
	8	Leguminous seeds (No. 5).
	9	Seeds (No. 16).
		(These are eaten in the pod.)
	3	Seeds of *Abrus precatorius.*
	9	Oat husks, some vegetable matter.
25-4-09.	12	*Myrmecocystus setipes.*
	1	*Serica lugubris.*
	1	*Sphenoptera gossypii.* (?)
	7	Wheat grains.
	1	Oat.
	34	Leguminous seeds (No. 5).
	4	Seeds (No. 9).
	1	Seed (No. 16).
	2	Leguminous seeds (No. 3), much vegetable matter including many (43 approx.) oat husks.

Stomachs examined—contd.

25–4–09. 1 *Opatrum* sp.
8 *Himatismus* sp.
1 *Sphenoptera gossypii*. (?)
9 Oats.
12 Young oat blades.
2 Leguminous seeds (No. 18).
21 „ „ (No. 5).
5 „ „ (No. 16).
and other vegetable matter.
1 Small pebble.
1 Green glass bead.

25–4–09. 1 *Camponotus compressus*.
4 *Polyrachis simplex*.
3 *Himatismus* sp.
2 *Myllocerus discolor*.
1 Weevil sp.
13 Oats.
23 Leguminous seeds (No. 5).
7 Seeds (No. 16).
23 Leguminous seeds (Nos. 1, 4, 5, 20, 27).
1 Seed (No. 13).

25–4–09. 24 *Camponotus compressus*.
2 *Himatismus* sp.
8 Wheat grains.
12 Leguminous seeds (No. 5).
24 Large leguminous seeds of various kinds.

5–4–09. 8 *Camponotus compressus*.
6 *Himatismus* sp.
2 Oats.
2 Seeds (No. 13).
7 Peas (No. 7).
3 Leguminous seeds (No. 5).
112 Seeds (No. 16).
2 Bits of glass.
2 Bits of coal.

25–4–09. 3 *Camponotus compressus*.
2 *Myrmecocystus setipes*.
1 *Himatismus* sp.
3 Seeds (No. 14).
1 Pea.
6 Leguminous seeds (No. 5).
241 Seeds (No. 15).
A little *Ficus* fruit.

25–4–09. 2 *Mesomorpha villiger*.
6 *Himatismus* sp.
1 Weevil.
1 *Myllocerus* sp.
6 Oats.
13 Leguminous seeds (Nos. 17, 18, 21, 30).
11 *Panicum* sp. seeds (No. 10).
1 Red bead.

Stomachs examined—concld.

14–6–09.	32	*Camponotus compressus.*
	4	*Polyrachis simplex.*
	1	*Cremastogaster subnuda.*
	7	*Himatismus* sp.
	22	*Opatrum depressum.*
	2	*Opatrum* sp.
	21	*Penthicus* sp. (No. 2442).
	6	*Tanymecus hispidus.*
	1	Carabid. (Pusa No. 1822.)
	1	*Hapalochrus fasciatus.*
	31	*Pulvinaria* sp.
	2	Leguminous weed seeds.

Summary.—Of 948 insects taken by 30 birds 6 are beneficial, 203 injurious, and 739 neutral. Twenty-nine birds took insects, of which 5 took beneficial, 19 injurious, and 28 neutral. Two birds took spiders. All took seeds, in nearly every case these being in greater bulk than the insect food. One bird took seeds only ; wheat was taken by 7 birds, oats by 23, peas by 2, and *Ficus* fruit by one only, being picked up from the ground.

Conclusion.—Probably beneficial.

With regard to the food of this species, it is interesting to note that those birds containing oats, grain and a large percentage of weed seeds, were those which were shot earlier in the day than those with a large percentage of insects. The birds presumably enter cultivated areas only early in the morning, retiring to high crops, waste lands or jungle, where there is long grass and good cover, as soon as work commences in the fields. They are seen comparatively seldom in the open during the day and then I believe only when they have been disturbed from cover.

Those birds recorded with a large proportion of insect food, were shot between 10 A.M. and 5 P.M. I do not know if standing crops are attacked. None of the birds examined had obtained their food from this source. The grain and possibly some of the weed seeds had been gleaned up from stubbles, whilst the greater proportion of the weed seeds and I believe all the insects were not taken on cultivated areas, but in rough jungle. The contents of several of the stomachs proved that this bird is sometimes a foul feeder. Several glass beads and stones or pebbles fairly brightly coloured were

eaten, and it thus seems that the partridge is fond of taking bright objects. They have only been noticed to take these in wet weather, the beads and pebbles lying on the ground would at that time appear more brightly coloured than if on dry ground, and in a dry atmosphere.

1373. *F. pictus.*—Painted Partridge. The food of the Painted Partridge is much the same as that of the Black—insects and grubs, grain and seeds, and tender shoots and buds of grasses and weeds of many kinds, constitute its normal diet, the larvæ and eggs of white ants being special favourites, but in the neighbourhood of villages it is often like its northern congener, a foul feeder, and is never, I think, so good a bird for the table.—H. M. G. B., 2, 23.

1374. *F. chinensis.*—Eastern or Chinese Francolin. Mr. Oates—"Its food appears, in addition to ants, beetles and so forth, to consist in a great measure of buds and shoots."—H. M. G. B., 2, 28.

1375. *F. pondicerianus.*—Grey Partridge. This partridge feeds on grain and seeds of all kinds, and is very partial to small grasshoppers, white ants and other insects. It is often accused of being a dirty feeder when living near villages, but I am inclined to think unjustly.—Jerd. B. I., 3, 572.

They feed on grain of all kinds, grass seeds and insects, especially white ants and their eggs and on young leaves of mustard, peas and other herbs—pecking the grain out of the droppings of passing animals. Boldly do they come out at daybreak on to the open threshing floors of the native peasants. Unquestionably in the neighbourhood of villages at seasons when grain is scarce, these birds are inveterately foul feeders.—H. M. G. B., 2, 53. It feeds on seeds and insects and is probably at times a foul feeder, though as Jerdon correctly says it is often unjustly accused.—F. I., 4, 140. A most unclean feeder.—Bombay G. Ahmedabad, Vol. IV, p., 27 ; Balaghat, D. G., 37 ; Damoh, D. G., 12 ; Saugor, D. G., 12.

1376. *F. gularis.*—Kyah or Swamp-Partridge. The Kyah is easily reconciled to confinement, even when taken old, and eats

greedily of almost everything, but having a special preference to white ants.—Jerd. B. I., 3, 575.

In confinement, they should be well fed with paddy or unhusked rice, which they will eat freely.—H. M. G. B., 2, 62.

1377. *Perdix hodgsoniæ.*—Tibetan Partridge. Here and there fed by the melting snow above, little patches and streaks of mossy herbage on which I suppose the birds must have been feeding.—H. M. G. B., 2, 66.

1378. *Tetraogallus himalayensis.*—Himalayan Snow-Cock. (Mountaineer). When feeding they walk slowly up hill, picking up the tender blades of grass and young shoots of plants occasionally stopping to snatch up a certain bulbous root of which they seem very fond. "They feed on the leaves of plants and grass, and occasionally on moss, roots and flowers; grass forms by far the largest portion. They are very partial to the young blades of wheat or barley. Though they will eat grain I doubt if they would live long without an occasional supply of their natural green food of grass and plants."—Jerd. B. I., 3, 553; H. M. G. B., 1, 270-271. Insects, buds, roots, grass, moss and fern.—E. B. C. N. H., 229.

1379. *Tetraogallus tibetanus.*—Tibetan Snow-Cock. Henderson—"They had been feeding on grain all picked out of the droppings of cattle and horses."—H. M. G. B., 1, 276.

1380. *Lerwa nivicola.*—Mountaineer. "The Snow-partridge feeds on moss and the tender shoots of small plants."—Jerd. B. I., 3, 557. H. M. G. B., 2, 5. Moss, seeds, and insects. E. B. C. N. H., 230. Feeds on shoots, moss, and roots.—A. leM., 109.

Sub-order *Peristeropodes.*—

Megapodiidæ.—Fallen fruit, seeds, berries, worms, snails, insects and worms.—E. B. C. N. H., 191.

1381. *Megapodius nicobariensis.*—The stomachs of all we examined contained tiny land shells—larvæ of insects, dissolved matter apparently vegetable, and minute fragments and particles of quartz or other hard rocks.—H. M. G. B., 1, 120. Young in captivity entirely fed on white ants.—B. N. H. S. J., 12, 21.

The *Phasianidæ* from a general economic standpoint are of very great importance, more so, in fact than any other group of birds. Not only are large industries centred round the domestic species—turkeys, guinea-fowl, and chickens—directly with regard to their value as food to man, but the wild species are also almost equally important from the direct products we derive from them, and because of the large industries that owe a very large percentage of their support to the existence of these birds, and from the benefits that sport in connection with these birds brings into a country. We do not discuss the domestic species here, but it is worthy of mention that in orchard cultivation these birds do an immense amount of good by devouring grasshoppers and other insects, and in fact do and will prove a valuable asset on any farm, both directly and indirectly. I have not examined many stomachs of poultry, but those that I have contained as a rule mostly insects, of which more than half are grasshoppers. Beetles form a considerable proportion, especially common species of Tenebrionids. They eat a good deal of animal matter, such as frogs and mice, and therefore are to some extent scavengers.

Of the wild species—the Pheasants and the Partridges—we hear that local damage is done by the Peacock, Jungle-fowl, some of the Quails and the Chucor to grain crops and millets at times. Those species, however, that feed on grain can only do so at certain periods of the year, and, though some considerable damage may occur at these times, the good done at other periods of the year in all probability more than counterbalances any harm done; for, judging by the records we have of the Black-partridge, these birds feed very largely on injurious insects at any rate during such times as grain is not available in the field as food, and in all probability much of the grain eaten is obtained by gleaning.

Of the food of the *Phasianidæ*, Evans (C. N. H. 203) says "Their food is chiefly vegetable and includes shoots, buds, leaves, grass, bulbs, seeds, berries and other fruits, with a certain amount of grit; but worms, molluscs, ants and their cocoons swell the list." It is noticeable that most Indian species feed to a large extent on

Termites when these insects are available, many of the birds habitually scraping in the ground to get at them. Some are also at times foul feeders.

The following is from the Second Annual Report S. A. C. L. B. (Fuller, Natal, 1908), with regard to the locust-egg eating propensities of the Guinea-fowl, presumably the bird usually known by that name. "Whilst these birds are our best natural allies, many other animals can be mentioned such as baboons and all kinds of predaceous insects, rodents, and reptiles. Special mention should be made of the habit of the Guinea-fowl and mier-cat in digging up locust eggs and devouring them. Several large areas of eggs were thus destroyed in Moreed and Zoutpansburg, and immense swarms of 'voet-gangers' (hoppers) were destroyed by the former in all parts of the colony. The guinea-fowl contrary to popular belief does not stay in the lands during summer, but retires to the bush in order to mate and rear its young. Whilst there it destroys many 'voet-gangers' in places which are difficult for us to work. Observations also show that they do no harm to crops." It would therefore seem that a judicious importation of these birds into locust producing districts in India might be of some considerable value. In spite of the fact that the Nilgiri Game Association have apparently failed to introduce the Guinea-fowl into their district (Nilgiri D. G., 36-37), these birds thrive in many parts of the country, and are kept domesticated in large numbers, and we see no reason why wild birds of various species if turned down should not thrive also, in suitable localities. The keeping of poultry is certainly to be recommended always. In addition to their value as food the feathers of many species are used for decorative purposes, and in minor industries for making artificial flies for fishing, arrow flights, etc.

The Peacock (*P. cristatus*) occurs in the North-West being replaced in Burma by its ally *P. muticus*. The Jungle-fowls are found generally in hilly jungle tracts and the Pheasants are entirely confined to the hills, chiefly the Himalayas, four being practically confined to Burma and the Malayan region.

Of the Quails and Partridges about seven species are found in the plains, two of which are migrants, notably the common Grey Quail. They are found principally in the more Northern parts of India, but are generally distributed. The Kyah is a swamp haunting species. The other species are from the hills, some being found at very high altitudes, and six are from Burma and the Malayan region.

"Partridges and Quails (see Hume and Marshall) are kept by natives in Northern India for fighting purposes. They are confined in small cages and carefully trained for the purpose." (Watt). Putting aside all other considerations from their feeding habits alone this group is probably beneficial in spite of the fact that some damage is done to grain crops.

HEMIPODII.

Turnix.—The food of all species consists principally of small seeds; small insects and tips of grass and leaves are also eaten.—F. I. IV, 120.

1382. *Turnix pugnax.*—Bustard Quail. It feeds on grain of various kinds, but also very much on small insects, larvæ of grasshoppers and the like.—Jerd. B. I., 3, 596.

Small millets, grass-seeds, ants, white and black, and other small grains and insects constitute its food (taigoor). Grass-seed and the tips of tender blades of grass are probably its chief food; but it also eats a variety of tiny seeds, beetles and other insects. It seems to be very little of a grain eater (*plumbipes*).—H. M. G. B. II, 171, 178.

1383. *Turnix dussumieri.*—Little Button Quail. "Two or three shot during the cold season had eaten only grass seeds while two shot in my garden in Etawah had fed almost exclusively on termites." Captain E. A. Butler writes of a young bird, "In confinement it lived almost exclusively on white ants until full grown, after which it fed upon seed."—H. M. G. B., II, 194, 97.

1384. *Turnix tanki.*—Indian Button Quail. I have never seen them in fields or stubbles, nor had any of the few I have examined eaten any grain, only grass seeds and small black fragments, which might have been portions of small hard seeds or of tiny coleoptera.—H. M. G. B. II, 189.

Stomachs examined—

6-3-07.		Small weed seeds.
12-3-08.		Small weed seeds.
18-3-09.	1	*Phidole malinsi.*
	12	*Camponotus compressus.*
	1	*Himatismus* sp.
	45	Leguminous seeds (No. 5).
	145	Weed seeds (No. 16).
		A variety of weed seeds.
18-3-09.	10	*Camponotus compressus.*
	1	Noctuid moth.
	43	Weed seeds (No. 5).
		A variety of other weed seeds.
	1	Small pebble.
18-3-09.	1	*Himatismus* sp.
	1	*Opatrum* sp.
		A variety of small weed seeds.
18-3-09.		Small weed seeds.
18-3-09.		Small weed seeds.
18-3-09.		Small weed seeds.
5-5-07.	1	Tenebrionid.
	3	Small Elaterids.
		Small weed seeds.
10-07.		Small weed seeds.

Summary.—Of 31 insects taken by 10 birds one is injurious, and 30 neutral; none are beneficial. Four birds took neutral insects, one injurious and all had eaten weed seeds in far greater proportion than insects.

This bird usually occurs in jungle, but during 1907 it was sometimes to be seen in a cotton crop. It is apparently almost purely seed-eating, but rarely taking insects. The weed seeds eaten are usually small and are of the same varieties as those found in the Black Partridge.

1385. *Turnix albiventris.* Nicobar Button Quail. Small seeds.—H. M. G. B. II, 199.

1386. *Turnix blanfordi.*—Burmese Button Quail. Grain, seeds, small insects, and tiny green shoots.—H. M. G. B. II, 184.

These little Quails haunt grass lands and low jungle scrub, the three first mentioned species occurring in the plains. Their food consists principally of a variety of small weed seeds, with the addition of a few insects. They are of practically no importance from an economic standpoint, if anything being beneficial.

GRALLATORES.

Feed on fish, reptiles, molluscs, insects, and a few on vegetable matter.—A. C. M., 121.

Grallæ.—Sub-order *Fulicariæ. Rallidæ.* Rails, Crakes and Coots. The food is in most forms chiefly vegetable, consisting of various water plants, seeds, etc., but in addition most of the species live on insects and their larvæ and on small crustaceans.—F. I., 4, 157. The Gallinulinæ (coots and water hens) live chiefly on vegetable matter, seeds, etc. (713). The rails (Rallinæ) feed much on small molluscs, insects and their larvæ, occasionally on grain and vegetable matter. (721).—Jerd. B. I., 3, 721, 713. Chiefly vegetable.—S. M. F. Z., 1908. Partially vegetable diet.—A. C. M., 122.

The food consists of worms, molluscs, insects and their larvæ, green herbage, tubers, roots of aquatic plants and seeds. *Porphyrio* .....cause serious damage to potato, rice, and corn-crops.... Some of the stronger species occasionally prey on mice, lizards, young birds and eggs.—E. B. C. N. H., 245.

1387. *Rallus indicus.*—Indian Water Rail. Their food...consists chiefly of insects of all kinds, small shells, worms, grass and other seeds and green vegetable matter.—H. M. G. B. I., 1, 259. It feeds partly on small insects, mollusca and worms, and partly on vegetable matter—F. I., 4, 159.

1388. *Rallus aquaticus.*—Water Rail. Of its Indian habits we know nothing. Macgillivray remarks "Its food consists of worms, slugs, helices, limnæ, insects and seeds of gramineæ."—H. M. G. B. I, 1, 262.

1389. *Hypotænidia striata.*—Blue-breasted Banded Rail. Their food is very varied, chiefly, I think, worms, small snail and other shells, tiny grasshoppers, and other insects, but grass-seeds and vegetable substances are generally found mingled with their other food, and with it an abundance of coarse sand...In confinement eating greedily, worms, small snails, boiled rice, vegetables, almost anything of this kind you can give them.—H. M. G. B. I, 1, 250. Beetles appear to be the chief food.—B. N. H. S. J., 165.

1392. *Porzana parva.*—Little Crake. The food of this species seems to consist far more exclusively of insects than that of Baillon's. In more than a dozen specimens that I have examined the stomachs contained water bugs and beetles, small insects of all kinds, and larvæ of various, to me, quite unknown, species, with here and there a few small black seeds and a trace of vegetable matter...many minute pebbles.—H. M. G. B. I, 210. Mainly on water-insects and larvæ.—F. I. IV, 165.

1393. *Porzana pusilla.*—Eastern Baillon's Crake. Larvæ under lotus, etc., leaves form a large portion of their food. "Others say that this species feeds very little on anything but insects. I have always found quantities of small seeds and remains of green vegetable matter in the stomachs, besides tiny snail shells, water beetles, and all kinds of aquatic insects and their larvæ. On several occasions I have found the tiny wild rice grains mixed with other food, but though they keep so much about rice fields, I have never noticed that they had eaten paddy, the grains being perhaps too large."—H. M. G. B., 1, 205.

1394. *Porzana maruetta.*—Spotted Crake. This bird feeds on aquatic insects, and insect larvæ, small worms and small snails, as well as tender shoots of water herbage and grass seeds, and usually seeks its food in shallow water or on moist and swampy ground, etc.—H. M. G. B., 1, 215.

1396. *Rallina fasciata.*—Malayan Banded Crake. When one has recorded the food, flight, and habits of one of these crakes

there remains little to be said about the others unless you have watched them very closely.—H. M. G. B. I, 1, 235.

1397. *Rallina canningi.*—Andamanese Banded Crake. Captain Wimberley writes: "Its food appears to consist of insect and fresh water fish. The latter I infer, as some of those I sent you were taken in snares laid on the ground baited with fresh-water shrimps, which were all eaten."—H. M. G. B. 1, 242. A forest bird haunting swampy ground,"..." and feeding on insects and fresh water crustacea."—F. I. IV, 170. Beetles, grasshoppers, worms, small snails, caterpillars.—B. N. H. S. J. 2, 696.

1398. *Amaurornis fuscus.*—Ruddy Crake. Rush-fringed ponds on the leaf-paved surfaces picking up all kinds of insects and the larvæ of these so abundantly adhering to the lotus leaves.... All kinds of aquatic insects, little moths, mosquitoes, tiny worms, larvæ of all sorts, grass seeds and small grains of various kinds and tender green shoots or leaves (and as usual a quantity of fine gravel) constitute the contents of their stomachs, but in very varying proportions, not only according to localities and perhaps individual idiosyncracies, but according to the hour at which they were killed; and I came to the conclusion (I give it for what it may be worth) that in the early morning when out in the open they feed chiefly on insects and that during the day...they feed more on seeds and vegetable substances.—H. M. G. B. 1, 219. Feeds on insects and seeds.—F. I. IV, 171. The moths noted probably belong to the Hydrocampinæ, probably various spp. of *Nymphula.*

1399. *A. bicolor.*—Elwes' Crake. The contents of the stomach of one specimen are noted as "insects, grain and gravel," and Godwin-Austen says that two in capacity ate earthworms greedily.—H. M. G. B. 1, 224. Earthworms in captivity, XLIII (11), 175.

1400. *Apakool.*—Brown Crake. Its food too, although similar to that of the other species, includes a far larger proportion of tiny snail and other shells and of worms and slugs...After a good fall of rain...chiefly on small worms.—H. M. G. B. I, II, 226.

1401. *Amaurornis phoenicurus.*—White-breasted Water-hen. It feeds on both grain and insects.—Jerd. B. I. III, 720. It feeds on insects, molluscs, and grain, etc.—F. I. IV, 174.

Stomachs examined—

22–1–09.	102	Small seeds.
	3	Leguminous weed seeds.
	3	Small spiral shells. (*Melania tuberculata.* Müll.
	8	Pieces of root.
	10	Pieces of bulbous root of a water weed.
	1	Small pebble.
23–7–08.	1	*Liogryllus bimaculatus.*
	2	*Apis florea.*
	1	*Œcophylla smaragdina.*
	1	*Phidole malinsi.*
	1	*Onthophagus cervus.*
	3	Carabid larvæ.
	3	Beetles (Remains of Tenebrionids ?).
	6	*Opatrum* sp.
	1	*Aphanus sordidus.*
	3	Crickets (remains) ?
	4	Leguminous weed seeds.
	57	Small grass seeds.
7–9–08.	2	*Camponotus compressus.*
	1	*Myrmecocystus setipes.*
	1	*Atmetonychus peregrinus.*
	1	*Myllocerus* sp.
	12	*Phytoscaphus triangularis.*
3–10–07.	5	*Labidura riparia.*
	6	*Onthophagus cervus.*
	17	*Opatrum* sp.
	23	*Myllocerus* sp.
		Some weed seeds and roots.
	3	Small stones.
		Broken pieces of shells—*Corbicula orientalis* Lank & *Unio javidens.*
8–10–08.	1	Batch of *Mantis* eggs.
	79	*Myllocerus discolor.*

Summary.—Of 169 insects taken by 5 birds, 5 are beneficial, 121 injurious and 43 neutral. One bird took a batch of Mantis eggs, these being beneficial, 1 took beneficial insects, 4 injurious, and 3 neutral. Three took vegetable matter, chiefly water weeds : 2 took shells.

1402. *Gallinula chloropus.*—Moorhen. The food of the water hen is chiefly vegetable, but it also takes aquatic insects, larvæ and even it is said small fish.—Jerd. B. I., III, 719.

Like other Rails it feeds on various kinds of vegetable food and on insects.—F. I. IV, 176.

1403. *Gallicrex cinerea.*—Kora or Water-cock. It feeds on rice and other grains, on shoots of various water plants, and also on small mollusca and insects.—Jerd. B. I. III, 717. Its food is mainly vegetable.—F. I. 3, 178.

Porphyrio cause serious damage to potato, rice, and corn-crops.—E. B. C. N. H., 245.

1404. *P. poliocephalus.*—Purple Moorhen. It feeds chiefly on seeds and vegetable matter, committing great havoc on the rice fields.—Jerd. B. I. III, 714. Its food is mainly vegetable and it commits great havoc in rice fields by cutting down the growing rice.— F. I. IV, 180. Damages paddy.—B. N. H. S. J. XIV, 764.

1405. *Fulica atra.*—Coot. The Coot feeds chiefly on vegetable matter, seeds and shoots of aquatic plants.—Jerd. B. I. III, 716. The food consists of water plants, insects, mollusca, etc.—F. I. IV, 181.

Heliornithidæ.—Finfoots. The food is in all cases of small fish, crustaceans, insects and seeds.—E. B. C. N. H., 267.

1406. *Heliopais personata.*—Masked Finfoot. The food consists of mollusca and insects, probably of vegetable substances also.—F. I. IV, 183.

Rallidæ. Of the Rails two species occur in the plains. The Crakes (*Porzana*) are all winter visitors to the plains, while *Amaurornis*, the Coots and Moorhens are nearly all residents. The whole group are marsh birds, the Moorhens and Coots spending much of their time on the water. None are really beneficial, and in one or two cases considerable damage is done to paddy.

The *Heliornithidæ* are represented by one species which is local and rare.

GRALLÆ.

GRUIDÆ.

Cranes.

Feed much on grain, a few also on insects, frogs, and fish.—Jerd. B. I. III, 661. Cranes are in the main vegetable feeders, though they occasionally eat insects, reptiles and fish.—F. I. IV, 185. The food consists of grain, pulse, acorns, shoots, flowers, roots, tubers, and the like, with the occasional addition of small mammals and birds, reptiles, amphibians, worms, insects, and even fish.—E. B. C. N. H., 253.

1407. *Grus communis.*—Common Crane. It feeds chiefly on grain committing great havoc in the wheat fields, and in rice fields in Bengal, but it also eats shoots of plants and flowers, and occasionally, it is said, insects and reptiles. On one occasion I found that the flowers of *Carthamus tinctorius* had been the only food partaken of. It is stated in China to devour sweet potatoes. It is occasionally hawked by the "Bhyri" (*Falco peregrinus*).—Jerd. B. I. III, 665.

"Perhaps minute shells or insects on sand. A Crane recently arrived before there is grain, or young juicy shoots to eat, and that is perforce feeding chiefly on insects, worms, small frogs, and even fishes, is no doubt very indifferent eating, but the same bird four months later, when for six weeks it has been gorging itself daily with gram, wheat, rice, pulses, and peas of various kinds, almost to the exclusion of animal food, is as fat, tender and well-tasted a bird as can be found. In India the Crane undoubtedly prefers grain of all kinds, wheat, gram, rice and pulses, together with the tender young shoots of these to all other food. Perhaps of all things they most love the young pods of arhar or dhal (*Cajanus indicus*). Not only do they eat the young pods at such times, but also quantities of the yellow pea-like flowers, and at other times too, flower buds do not come amiss to them, and Jerdon mentions one he had examined that had fed exclusively on the buds of the safflower. Vegetables also attract them, and in China

(Swinhoe) they feed chiefly at one time on the sweet potato." In the Punjab these Cranes are very partial to the water-melons, and appear to attack "the melons chiefly for drinking purposes," though sometimes the seeds are eaten. These water-melons are of no market value. "I myself believe the common Crane to be by preference mainly a vegetarian; but at all times a small admixture of animal food may be traced in the stomachs of some birds, and when their favourite food is scarce, they eat water-crickets and other insects, slugs and worms, small shells, both land and water, and I have found the remains of small fish occasionally in their gizzards. Of course these latter contain, like those of all such birds, quantities of small pebbles, mostly quartz, some as large as peas, a few at times larger.—H. B. G. B. III, 25 = 27. Cranes that have fed for a time on the grain and shoots of wheat, rice, gram, arhar, and other crops are delicious; ill-fed birds are coarse.—F. I. IV, 187.

Anthropoides virgo and *Grus cinerea* (= *communis*) occur in flocks in wheat fields when the wheat is ripening. They do much damage to the crops and leave as soon as the wheat fields are bare. Bomb. Gaz., Broach, 360.

1408. *Grus leucogeranus*.—Great White Crane or Siberian Crane. Rushes and aquatic plants, exclusively a vegetable feeder. "I have never found the slightest traces of insects or reptiles (so common in those of other species) in any of the 20 odd stomachs of these white Cranes I have myself examined. The stomach contains an enormous amount of pebbles. Other Cranes and notably the common and the Demoiselle daily pay visits in large numbers to our fields, where they commit great havoc, devouring grain of all descriptions, flowers, shoots, and even some kinds of vegetables. The white Crane, however, seeks no such dainties, but finds its frugal food, rush seeds, bulbs, corms, and even leaves of various aquatic plants, in the cool waters where it spends its whole time.—H. M. G. B. III, 16."

1409. *Grus antigone*.—Sarus. Saruses feed upon vegetable substances, insects, earthworms, frogs, lizards and other small

reptiles with an occasional snake thrown in by way of condiment.—D. B. P., 38.

"Their food is very varied, frogs, lizards and all small reptiles, insects of all kinds, snail and other land and water shells, seeds, grains and small fruits of various kinds, green vegetable matter and the bulbous roots of various species of aquatic plants, and they seem to feed indifferently on wet and dry fields or dry grassy uplands, on the margins and in the shallows of rivers, broads and swamps.....on the young paddy plant and sometimes do considerable damage to the nurseries.....probably also other green shoots, grasshoppers and frogs, and perhaps young fish.....I do not think they catch live fish, although the young when domesticated are fed by the Burmans on small fish and shrimps.—H. M. G. B. III, 5. It feeds less exclusively perhaps on grain than the other Cranes met with in India.—Jerd. B. I. III, 663."

Koolan and Saras Cranes live on frogs and fish.—Punjab Gaz., Hissar, 20. Apparently obtain some portion of their food by digging in the ground with their bills.

1411. *Anthropoides virgo*.—Demoiselle Crane. Though I have found animal food similar to that devoured by the Common Crane in the gizzards of the present species, it has always been in small quantities, and the greater bulk has always proved to be grain and green vegetable matter. Mr. G. Vidal "In Sattara—stubbles in early morning—their favourite food is the karda or safflower oil seed (*Carthamus tinctorius*)." Mr. G. Davidson "In Sholapur and Sattara districts—principally on karda."—H. M. G. B. I. III, 35-36.

Feeding in early morning in karda or safflower, of which they are particularly fond.—Bom. Gaz., Vol. XIX, 40. In the Daman a sort of field mouse (Drui) is often very destructive to the crops, and multiplies exceedingly till drowned out by the floods, or exterminated by the Adjutant and Cranes.—Punjab Gaz., Dera Ismail Khan.

The Kulan are fond of fields of gram, when the grain has not yet hardened.—Punjab Gaz., Delhi.

The Koolan spends the day near or on the River Sutlej, and flies inland to feed on the green crops, or sown grain morning and evening.—Punjab Gaz., Ludhiana.

Koolan and Saras Cranes live on fish and frogs. The Koolan is also partial to seeds of wheat and barley.—Punjab Gaz., Hissar, 20. *Anthropoides virgo* and *Grus cinerea* (=*communis*) occur in flocks in wheat fields when the wheat is ripening. They do much damage to the crops, and leave as soon as the wheat fields are bare.—Bomb. Gaz., Broach, 360. Paddy.—B. N. H. S. J. XIV, 766.

It is very destructive to grain fields, especially wheat in Central India, and to Chenna (*Cicer arietinum*) in the Deccan. It is stated that they occasionally eat mice, snakes, etc.—Jerd. B. I. III, 667. This species together with grey geese is said to do an immense amount of damage to young cereals of all sorts, but especially wheat in various localities in the Central Provinces (Saugor, Hoshangabad, etc.)

Cranes with the exception apparently of the Great White Crane are all injurious in India, committing great havoc on most cold weather crops, especially the young cereals. They occur chiefly in Northern India and Burma in the cold months.

Otididæ.

Their food is chiefly insects, occasionally in dearth of this aliment shoots of plants, grain and vegetable matter.—Jerd. B. I. III, 607. The diet consists chiefly of juicy plants, such as young corn and turnips, clover and plantains, but it includes berries and seeds, insects, and their larvæ, molluscs, myriapods, frogs, or even small reptiles and mammals.—E. B. C. N. H., 263.

1412. *Otis tarda*.—Great Bustard. Our single Indian specimen bird fed entirely on green mustard leaves, and I may note that according to all authorities it chiefly feeds on grain and leaves, though also eating insects and does not appear to be ever the coarse feeder that its Indian ally is.—H. M. G. B. I, 2.

1413. *Otis tetrax*.—Little Bustard. With us they live chiefly on the leaves of the sarson, a kind of mustard, but I have also found

remains of insects and land shells in their stomachs and in Europe they are said to eat slugs, snails and small reptiles.—H. & M. G. B. I, 4. Chiefly vegetable matter.—Jerd. B. I. III, 625.

1414. *Eupodotis edwardsi*.—Great Indian Bustard. In long grass for grasshoppers, not for the grass (*Roussa*) seeds. Bustards change their ground much according to the season, and the supply of grasshoppers and other insects. "Besides grasshoppers, which may be said to be the favourite food, the Bustard will eat any other large insect, more especially Mylabris or blistering beetle, so abundant during the rains: the large Buprestes, Scarabaei, caterpillars, etc., also lizards, centipedes, small snakes, etc. Mr. Elliot found a quail's egg entire in the stomach of one and they will often swallow pebbles or any glittering objects that attracts them. I took several portions of a brass ornament, the size of a No. 16 bullet out of the stomach of one Bustard. In default of insect food, it will eat fruit of various kinds, especially the fruit of the Ber (*Zizyphus jujuba*) and Caronda (*Carissa carandas*), grain and other seeds, and vegetable shoots."—Jerd. B. I. III, 609.

It feeds on insects, especially grasshoppers, on small reptiles, on fruit, on grain, shoots of grass, etc.—F. I. IV, 196. Jerdon as above quoted.—H. & M. G. B. I III, 8-9.

They are very coarse feeders, and in the Punjab I have found large lizards, desert rats and all kinds of reptiles in their stomachs, besides quantities of the young green shoots of the lemon grass of which they seem very fond.—H. & M. G. B. I. III, 11. Lives chiefly on insects.—H. & M. G. B. I. III, 12. Large grasshoppers and locusts.—B. N. H. S. J. VI, 11.

NOTES.—In Rajputana (Deola, etc.), where this bird comes for breeding purposes, it feeds largely on the green blister beetle (*Cantharis tenuicollis*), which often taints the flesh of this bird.

1415. *Houbara macqueeni*.—Houbara. "Adams states that it is very destructive to young wheat fields in winter, eating the young shoots, but its chief food is doubtless insects of various

kinds." One English specimen shot was filled with caterpillars, snails and beetles.—Jerd. B. I. III, 615.

Very largely on the small fruit of the *Ber*, or the berries of the *Grewia*, or the young shoots of the lemon grass and other herbs: now picking off an ant or two, now a grasshopper or beetle and now a tiny land shell or stone, but living chiefly as a vegetarian and never with us (to judge from the thousands I have examined) feeding on lizards, snakes and the like.—H. & M. G. B. I. III, 18-19. On seeds and insects, and there is a small weed that covers open sand-waste in this part (Sirsa Dist.) of the Punjab that they are very fond of. It has a small flower-like a forget-me-not.—B. N. H. S. J. XVI, 373.

Seeds, small fruits, shoots of plants, and insects. Houbara are excellent eating as a rule, but they contract a strong and unpleasant flavour at times from feeding on shoots of mustard and other allied plants grown as oil-seeds.—F. I. IV, 197-198.

1416. *Sypheotis aurita.*—Lesser Florikin or Likh. The chief food of the Florikin is grasshoppers. I have found also blister beetles (*Mylabris*), Scarabæi, Centipedes, and even small lizards.—Jerd. B. I. III, 623.

"The Lesser Florikin, according to my experience, feeds largely on vegetable substances, berries, green shoots of grain, grasses and all kinds of herbs, but it also eats insects in abundance, especially grasshoppers and the glittering Cantharids, and Jerdon says, beetles, centipedes, and on small lizards.—H. & M. G. B. I. III, 37."

Hodgson notes: "Stomachs full of *Grylli*, thin coated small beetles"? Chrysomelides "fire-flies and gorgeous gad-flies." It eats chiefly *Grylli* and a few aromatic weed tops and sesamum buds.—H. & M. G. B. I. III, 37. Young brought up on grasshoppers.—H. & M. G. B. I. III, 39. Like other Bustards on seeds and insects.—F. I. IV, 200. "At times it is rather dangerous to eat them owing to their fondness for feeding on the blister-fly."—Bombay Gaz., Swat and Broach II, 45.

In Rajputana (Deola, etc.), where this bird comes for breeding purposes, it feeds largely on green blister beetle (*Cantharis tenuicollis*), which often taints the flesh of this bird.

1417. *Sypheotis bengalensis*.—Bengal Florikin. From February to April it may be seen stalking about the thin grass early in the morning, and it is noticed to be often found about newly burnt patches: one or more may be noticed making their way to some cultivated spot, a pea field.

In September and October when it feeds on the blister-fly (Cantharids), the florikin is considered unfit for food.—Bombay Gaz., Broach II. 359. Or mustard field to make its morning repast after which it flies back to some thick patch of grass to rest during the rest of the day. It feeds chiefly on insect food, grasshoppers, beetles and caterpillars, but will also eat small lizards, snakes, centipedes, etc., and Hodgson says, sprouts and seeds of various plants, and that their diet is chiefly vegetables. This, however, is opposed both to my experience and the analogy of the other members of this family. It occasionally, however, does eat sprouts and flowers of certain plants, but whether from desire or taken in along with some grasshopper or beetle, I cannot say.—Jerd. B. I. III, 616.

Patches of cultivation, particularly of mustard plants (*Rai*, *Tori* and *Sarson*) are acceptable to it as multiplying its chances of acceptable food.

The exquisitely flavoured bird is a rather promiscuous feeder: small lizards, young snakes, insects of most sorts, but above all locusts, and after them grasshoppers, beetles, the sprouts and seeds and succulent runners of various grasses, berries, strong fruits, aromatic lactiferous leaves and stems of various plants, with mustard tops and other dainties, all contributing to its nourishment. The largest portion of its usual food is vegetable, but insects abound, and especially locusts, and many are almost exclusively eaten. Cerealia are eschewed, but plenty of hard seeded grasses and such like are taken and a goodly portion of gravel, etc., to digest them.—H. M. G. B. I, 25, &c.

In October and November the bird is often found on the high strips of ground near to paddy-fields or even in the paddy, feeding on its blossom, while later on, in January, it is found in the mornings and evenings in the mustard crops, then in flower, but during the day it returns to its favourite high lands. Burnt grass lands it also much affects, and while there I have found its crop full of insects and even little bits of burnt grass or seed. In February and March (Bhutan Duars) they keep to the ooloo grass but near water, which becomes scarce at this time, and where the stunted cardamom, of which they are very fond, is found.

Assam: In early part of cold season they are found in mustard fields, where they find many insects, especially when the mustard is in flower. When this is cut low grass jungle, known in Assam as the ooloo grass, is their favourite haunt, especially when the grass has been burnt and young shoots are sprouting freely.—H. M. G. B. I, 27.

Stomachs examined—

12–3–07.	9	*Chrotogonus* sp.
	6	*Camponotus compressus.*
	4	*Opatrum depressum.*
	5	*Opatrum* sp.
	3	*Scleron orientale.*
	4	Cutworms.
		Some vegetable matter probably young shoots.
18–4–09.	2	*Acridium aeruginosum.*
	6	*Chrotogonus* sp.
	1	*Rhyothemis variegata ?*
	1	*Polistes hebræus.*
	1	*Opatrum* sp.
	15	*Mesomorpha villiger.*
	1	*Trox indicus.*
	3	*Derosphærus rugicollis.*
	8	Small Carabids ?
	1	Cutworm.
	1	Other larvæ.
	1	Tipulid larva ?

Summary.—Of 72 insects taken by 2 birds, 28 are injurious, 34 neutral, and 10 beneficial. Both birds took injurious and neutral insects: one took beneficial insects and the other took some vegetable matter.

Two beetles taken from the stomach of this species by Mr. Mackenzie, are *Blosyrus asellus* and *Colasposoma pulcherrima*. The Bustards are essentially plains birds, and confined to the more Northern parts of India, one species only—*S. aurita*—being found in the South. *Sypheotis* certainly appears to be beneficial.

LIMICOLÆ.

The food consists of crustaceans, molluscs, worms, and insects; rarely of small fish or eggs of other birds; but not uncommonly of vegetable matter, on which the "Thinocorythidæ" entirely subsist.

ŒDICNEMIDÆ.—STONE-PLOVERS AND STONE-CURLEWS.

1418. *Œdicnemus scolopax*.—Stone-Curlew. Almost entirely insects.—Jerd. B. I. III, 635. Insects, worms and snails.—F. I. IV, 205. Worms, insects, molluscs or even reptiles, frogs and mice.—E. B. C. N. H., 297.

Stomachs examined—

12–3–08.	9 *Chrotogonus* sp.
	4 *Camponotus compressus*.
	12 Remains of Tenebrionids, possibly *Mesomorpha*, and *Opatrum* spp.
13–6–09.	1 *Chrotogonus* sp.
	1 *Trox indicus*.
	23 *Himatismus* sp.
	1 Carabid sp ? (Pusa No. 2115.)
15–6–09.	4 *Chrotogonus* sp.
	3 *Gryllotalpa africana*.
	5 *Camponotus compressus*.

Summary.—Of 63 insects taken, 17 are injurious, 45 neutral, and 1 beneficial. One bird took a beneficial insect, all took neutral and all injurious ones.

Esacinæ.—Slugs, insects, mollusca and crustacea.—Jerd. B. I. III, 652.

1419. *Esacus recurvirostris*.—Great Stone-Plover. Crustacea, shell-fish and occasionally insects.—Jerd. B. I. III, 653. Crustacea, molluscs and occasionally insects.—F. I., 206. Crustaceans and molluscs.—E. B. C. N. H., 297.

1420. *Esacus magnirostris.*—Australian Stone-Plover. Crustaceans and molluscs.—E. B. C. N. H., 297.

Dromadidæ.

1421. *Dromas ardeola.*—Crab-Plover. Small crabs and other crustacea, and perhaps also on shell-fish.—Jerd. B. I. III, 659. Chiefly crabs.—F. I. IV, 206. Small crustaceans.—E. B. C. N. H., 296.

Glareolidæ.

Cursorinæ.—Coursers and Courier-Plovers.

Cursorius.—Feed almost entirely on Coleoptera and other insects.—Jerd. B. I. III, 626.

1422. *Cursorius coromandelicus.*—Indian Courser. Various insects, chiefly Coleoptera and the larvæ of certain grasshoppers.—Jerd. B. I. III, 627.

1423. *Cursorius gallicus.*—Cream-coloured Courser. The food consists almost entirely of insects, such as grasshoppers, yet it includes small molluscs.—E. B. C. N. H., 294.

Glareolinæ.—Swallow-Plovers. Semi-nocturnal, hawking moths in air.—Jerd. B. I. III., 633.

Pratincoles.—Ordinarily capture insects on the wing.—E. B. C. N. H., 294. Swallow-Plovers, hawk insects on river banks.—Bengal Gaz., Monghyr, 21.

Glareola, insects.—E. I. IV, 215.

1425. *Glareola orientalis.*—Large Indian Pratincole or Swallow-Plover. Principally moths, *Coleoptera* and *Hemiptera.*—F. I. IV., 255. Insects in the air, moths and beetles.—Jerd. B. I. III, 631.

1427. *Glareola lactea.*—Small Indian Pratincole. Mostly beetles and mosquitoes. They were found hunting for insects well after sunset.—B. N. H. S. J., XVI, 7. Several which I examined had partaken only of a species of *Cicindela.*—Jerd. B. I. III, 630.

PARRIDÆ.

1429. *Hydrophasianus chirurgus.*—Pheasant-tailed Jacana. Chiefly vegetable matter, but also on shells and water insects. In confinement thrive well on shrimps.—Jerd. B. I. III, 711.

Insects, molluscs, seeds and roots.—E. B. C. N. H., 300.

Stomachs examined—

5-2-09.	6	Broken bivalves. (*Corbicula orientalis?*)
	3	Opercula of ? (*Vivipara* or *Ampullaria.*)
	12	Small stones.
		A large quantity of sand.
4-4-09.	1	Small shell. (No. 14.)
		Several broken bivalves, other pieces of shell and a great deal of sand.

Summary.—Both birds contained shells and sand, one small

Stone-Plovers, Sand-pipers and Snipes.

CHARADRIIDÆ.

Charadriidæ.—Plovers. Plovers feed almost entirely on insects and worms.—Jerd. B. I. III, 633.

1430. *Strepsilas interpres.*—Chiefly small shells and various insects.—Jerd. B. I. III, 657. Turns over stones, etc., to find crustaceans, mollusca and worms.—F. I. IV, 224.

1431. *Sarcogrammus indicus.*—Red-wattled Lapwing. Various insects, shells, and worms.—Jerd. B. I. III, 648. Insects and small crustacea.—D. B. P. M. N., 57.

Stomachs examined—

12-3-07.	17	*Opatrum depressum.*
14-3-09.	2	*Chrotogonus* sp.
	1	*Apomecyna pertigera?*
	1	Leguminous weed seed.
	3	Small pieces of bamboo.
	1	Prawn.
14-4-09.	1	*Forficulid* clasper.
	1	*Onthophagus* sp.
	2	*Coleoptera* (mandibles).
	2	*Tipulid* larvæ.
14-4-08.	14	*Opatrum depressum.*
1-5-07.	33	Elaterid grubs.
10-5-07.	21	Elaterid grubs.
	3	*Mesomorpha villiger.*
13-6-09.	2	*Chrotogonus* sp.
	1	*Brachytrypes achatinus.*

Stomachs examined—contd.

	1 *Onitis distinctus.*
	1 *Cydnus nigritus.*
13-6-09.	7 *Chrotogonus* sp.
	Remains of some ants.
	1 *Onitis distinctus.*
	1 *Myllocerus* sp.
	1 Small shell (*Bythinia* sp.)
12-10-08.	3 *Chrotogonus* sp.
	3 *Onthophagus spinifer.*
	1 *Gymnopleurus miliaris.*
	4 Small weed seeds.

Summary.—Of 118 insects taken by 9 birds, 51 are injurious; 6 birds took injurious insects, 4 neutral and 4 injurious. One bird took a prawn, 1 a shell, and 2 vegetable matter.

1433. *Sarciophorus malabaricus.*—Yellow-wattled Lapwing. Beetles, white ants and worms.—Jerd. B. I. III, 650. Insects.—F. I. IV, 227.

1435. *Hoplopterus ventralis.*—Indian Spur-winged Plover.

Stomachs examined—

12-1-08. 10-2-07. 10-2-09. 12-4-07. 12-4-07. 9-10-08. 9-10-08. 8-11-07.	All contained small molluscs only (chiefly *Melania tuberculata*).

1436. *Vanellus vulgaris.*—Peewit. Habits similar to those of Indian Plovers.—Jerd. B. I. III, 644. Chiefly on worms, insects and their larvæ.—F. I. IV, 231.

1437. *Chettusia gregaria.*—Sociable Lapwing. Feeding in paddy-fields.—B. N. H. S. J. XVI, 8.

Charadrius.—Golden Plovers feed on worms and insects.—F. I. I. IV, 235.

1439. *Charadrius fulvus.*—Eastern Golden Plover. Beetles and other hard insects, worms, etc.—Jerd. B. I. III, 639.

1447. *Aegialitis dubia.*—Little Ringed Plover. Insects.—Jerd. B. I. III, 364, F. I. IV, 243.

Stomach examined—

14–4–09. 1 *Scleron denticolle.*
1 Weevil.
6 beetles. (Pusa No. 1184).
1 Carabid grub.
1 Tabanid.
8 Dipterous larvæ.

Summary.—Two injurious insects, 1 beneficial, and 15 neutral.

Hæmatopodinæ.

Hæmatopus.—Various molluscs, worms, and small crustacea.—Jerd. B. I. III, 659.

1450. *Hæmatopus ostralegus.*—Chiefly mollusca; open bivalves; also worms and various sea insects.—Jerd. B. I. III, 660. Molluscs and crustacea.—F. E. IV, 246. Feeding on crustaceans mostly.—B. O. H. S. J. XIV, I. Molluscs and shell-fish.—Bombay Gaz., Ahmedabad, IV, 91. Limpets in Scotland.—E. B. C. N. H. III, 56. Mussels.—E. B. C. N. H., 276.

1451. *Himantopus candidus.*—Insects, small molluscs, and worms.—Jerd. B. I. III, 7056; F. I. IV, 248. Insects, etc.—E. B. C. N. H., 277.

1452. *Recurvirostra avocetta.*—Small worms, young molluscs, and larvæ of water insects. (Pallas). In Central Asia on small worms, insects and saline, crustacea.—Jerd. B. I. III, 706. Insects, small molluscs and worms.—F. I. 4, 249. Aquatic creatures.—E. B. C. N. H., 278.

1453. *Ibidorhynchus struthersi.*—Minute univalves.—Jerd. B. I. III, 686. Insects, and, it is said, crustacea and mollusca.—F. I. IV, 250.

Totaniinæ.—Sand-pipers pick up various small crustacea and mollusca, generally from the surface of the ground.—Jerd. B. I. IV, III, 696.

1454. *Numenius arquata.*—Shells.—B. N. H. S. J. XIV, 769. Insects, worms, berries, and so forth.—E. B. C. N. H., 288.

1456. *Limosa belgica.*—It feeds partly on insects, mollusca and worms, partly in India at all events on rice and millet.—F. I.

IV, IV, 255. They feed largely on rice, both wild and cultivated, their favourite food, but also eat seeds of some of the millets, of grass, sedges and the like, and numbers of small insects, tiny shells, and occasionally worms and grubs, and soft bodied crustacea. They feed in recently cut rice fields, sometimes in water picking insects off the surface, "or again walking along the water's edge on sands or mud banks, picking up small shells and shrimps."—H. M. G. B. I. III, 411-412.

1457. *Limosa lapponica.*—Small crustacea, annelida and mollusca.—F. I. IV, 257. Chiefly on small shrimp-like things, small mollusca, sand worms and insects, but most of their stomachs contained matter that I took to be minute acephalæ or jelly-fish.—H. M. G. B. I. III, 418.

1460. *Totanus hypoleucus.*—Common in paddy-fields from September to May.—B. N. H. S. J., XVI, 9.

1461. *Totanus glareola.*—Wet paddy-fields from August to May.—B. N. H. S. J. XVI, 9.

Stomachs examined—

6-1-07.	1 Zygopterid.
	4 Spiral shells. (*Melania tuberculata*).
	1 Shell.
	Some sand.
2-2-07.	3 Small snails. (*Planorbis* sp.).
20-2-08.	2 Small snails. (No. 5).
	3 Seeds.
1-3-09.	1 Small snail. (No. 5).
1-3-09.	4 Small snails. (*Planorbis*).
	1 Shrimp.
1-3-09.	A few pieces of some shells. (*Planorbis*) and some sand.
1-3-09.	Some aquatic vegetable matter.
	5 Shot.
1-3-09.	1 Shell. (*Planorbis* sp.).
	1 *Hyphoporus aper.*
	1 Small feather.
1-3-09.	2 Weevils.
	Other Coleopterous remains.
	1 Small black seed.
1-3-09.	4 *Myllocerus* sp.
	1 *Opatrum* sp. (Pusa No. 2499).
	1 *Mesomorpha villiger.*
	1 *Onthophagus pusilus.*
6-3-09.	1 Shell. (*Planorbis* sp.).

Stomachs examined—contd.

6-3-09.	1 Broken shell and some sand.
6-3-09.	2 Small shells. (*Planorbis* sp.)
6-3-09.	1 *Myllocerus sp.*
	2 Small seeds.
	3 Shells. (*Planorbis* sp.)
9-3-07.	1 Small dragonfly. (*Zygopterid*).
	1 *Camponotus compressus.*
	11 *Hydrophylids.*
	Some sand.
9-3-07.	3 *Hyphoporus aper.*
	1 *Opatrum* sp.
	Some sand.
12-3-08.	1 *Dragonfly larva.*
	1 Prawn.
	1 Shell and other broken shell remains. (*Planorbis* sp.).
23-4-07.	Some aquatic vegetable matter.
	Sand.
28-3-09.	1 *Camponotus compressus.*
	9 *Laccophilus flexuosus.*
	1 Coprid ? leg.
	1 Small piece of brick.
	1 Feather.
28-3-09.	1 *Laccophilus flexuosus.*
	1 *Myllocerus* sp.
	Other insect remains.
	Some sand.
28-3-09.	1 *Myllocerus* sp.
	3 *Laccophilus flexuosus.*
	Remains of shells. (*Planorbis* sp.) and vegetable matter.
28-3-09.	1 *Onthophagus dama.*
	5 *Laccophilus flexuosus.*
	2 *Opatrum* sp.
	One piece of shell. (*Planorbis* sp.)
19-11-08.	1 Small bivalve. (*Corbicula orientalis*).
	Shell remains.
12-12-07.	Bivalve remains. (*Corbicula orientalis ?*)
	Some sand.

Summary.—Of 55 insects eaten by 24 birds, 9 are injurious, 3 beneficial and 43 neutral. Of 12 birds that contained insects, 4 took beneficial, 9 neutral and 6 injurious. Sixteen contained shells, 1 a prawn, 1 a shrimp, 3 a feather, and 6 vegetable matter.

1462. *Totanus ochropus.*

Stomachs examined—

6-1-08.	3 Small bivalves. (*Corbicula orientalis*) some broken shells and sand.
19-3-08.	Remains of various shells. (*Planorbis* and *Melania*).
19-3-08.	Remains of various shells. (*Planorbis* and *Melania*).
	2 Carabid heads.

Stomachs examined—contd.

20-3-07.	1 Coleopterous elytron.
	A little sand.
24-3-07.	Empty.
22-3-08.	1 *Opatrum* sp.
	3 *Myllocerus* sp.
	Some insect remains (beetles).
	A little broken shell and sand.
12-4-08.	1 *Hyphoporus aper.*
	1 Crab ?
	Broken shells. (*Planorbis*) and sand.
12-4-08.	12 *Hyphoporus aper.*
	13 Small shells.
	1 Prawn.
	Some insect remains and sand.
11-11-07.	Broken shells. (*Planorbis*).
	Some sand.
11-11-07.	Empty.

Summary.—Of 20 insects taken by 10 birds, 15 are neutral, 3 injurious and 2 beneficial, 1 bird took beneficial insects, 1 injurious and 2 neutral. Shells were eaten by 6, a prawn by 1 and a crab by 1.

1464. *Totanus calidris.*—Redshank. Molluscs, crustaceans, worms, and aquatic insects.—E. B. C. N. H., 283.—Fish. B. N. H. S. J. XIV, 770.

Stomachs examined—

12-1-08.	1 Small snail. (*Corbicula orientalis.*)
	Some sand.
22-1-09.	1 Small snail. (*Corbicula orientalis.*)
	3 Small stones.
	Some green water weed.
	Some sand.

Summary.—Both birds took snails, one some aquatic weed.

1465. *Totanus fuscus.*—Spotted Redshank. Fish.—B. N. H. S. J. XVI, 766.

1466. *Totanus glottis.*—Greenshank. Occasionally eats fish.—E. B. C. N. H., 284.

1467. *Totanus guttifer.*—Armstrong's Sand-piper. "The stomachs of some I killed contained small fish and crustacea, while those of others were crammed with larvæ and small mollusca." (Dr. Armstrong).—H. M. G. B. III, 404.

1468. *Pavoncella pugnax.*—Ruff and Reeve. Feeds greedily on rice.—Jerd. B. I. III, 688. Insects, crustacea and worms.—F. I. IV, 270. Seeds, insects and worms.—E. B. C. N. H., 285.

Tringinæ.—Stints. Soft insects, worms larvæ, small crustacea and mollusca.—Jerd. B. I. III, 687.

Tringa.—Worms, small crustacea and insects and their larvæ, which are obtained either from the sand or mud banks on the coast, or in estuaries, or from marshy ground inland.—F. I. IV, 272.

1471. *Tringa minuta.*—Little Stint.

Stomachs examined—

14–4–09.	3 *Copelatus pugnax.*
	8 Small shells. (*Planorbis* sp.).
	Other insect remains unidentifiable.
15–4–08.	12 *Copelatus pugnax.*
	Shell remains.
20–*–09.	Small broken spiral shells. (No. 5).

Summary.—Fifteen neutral insects taken. All 3 birds had eaten shells.

Scolopacinæ.—Snipes feed on worms and soft larvæ.—Jerd. B. I. III, 669.

1482. *Scolopax rusticola.*—Woodcock-Worms.—Jerd. B. I. III. I have found worms of all sizes and shapes, grubs, larvæ, fragments of black Coleoptera, tiny scraps of grass, and a sticky glutinous animal substance. Besides this their gizzards always contain a quantity of gravel.—H. M. G. B. I. III, 316. Chiefly worms, grubs, and insects.—F. I. IV, 284. Worms, small molluscs, and insects.—E. B. C. N. H., 289.

1483. *Gallinago nemoricola.*—Wood-snipe. Not such a great devourer of worms as the Woodcock: large naked soft grubs, small aquatic insects and remains of insects especially tiny black Coleoptera, small hard black seeds probably accidentally taken, though Hodgson also notes these, and gravel.—H. M. G. B. I., 329. Grubs and insects.—F. I. IV, 286.

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* Month not recorded by error—T. B. F.

1484. *Gallinago coelestis.*—Common Snipe. Feeding chiefly at night on worms and various aquatic insects.—Jerd. B. I. III, 675. Worms, water grubs, aquatic insects and tiny water shells and crustacea, the entire food.—H. M. G. B. I., 3, 345. Feed chiefly on worms; also eat larvæ of aquatic insects, small crustacea and mollusca.—F. I. IV, 288. Worms, small molluscs and insects.—E. B. C. N. H., 290.

Stomachs examined—

9–1–08.	3 *Coleopterous elytra.*
	2 Small snails. (*Planorbis* sp.).
	Much sand.
23–2–09.	1 Small snail. (*Planorbis* sp.).
	4 Black seeds.
1–3–09.	Pieces of broken shell.
8–3–09.	3 Snail shells. (*Planorbis* sp.).
10–3–09.	Remains of a broken shell (?) and some sand
12–3–07.	1 Snail shell. (*Planorbis* sp).
12–3–09.	1 Shell. (No. 5).
	4 Black seeds.
	A little sand.
14–3–08.	3 *Coleopterous* elytra.
	1 Water Shrimp.
	1 Small mollusc.
15–3–09.	2 Snails. (*Planorbis* sp.).
	5 Leguminous weed seeds.
	Some grit and sand.
19–4–09.	2 Elaterid grubs.
	1 Cutworm.
	1 *Cydnus nigritus.*
	4 Grass blades.
19–4–09.	1 *Mesomorpha villiger.*
	1 *Hister* sp.
	1 Lamelicorn.
	1 Elaterid grub.
	2 Cutworms
	1 Geometrid larva.
	6 Blades of grass.
13–10–09.	A few snails. (No. 29.)
12–12–07	1 Small snail. (No. 5.)
	Some sand.

Summary.—Of 17 insects taken by 12 birds, none are beneficial, 6 are injurious and 11 neutral. Two birds took injurious insects, 4 neutral, 10 birds took shells, 5 vegetable matter, and 1 a shrimp.

1485. *Gallinago stenura.*—Pin-tailed Snipe. Of the food of the pintail and fantail snipe Hume says: "In the pintail you find all kinds of land organisms, grubs, caterpillars, small insects, crustacea, shells and grass, as well as and more frequently than worms, water grubs, aquatic insects, and tiny water shells and crustacea which constitute the entire food, in this country at any rate, of the fantail. H. M. G. B. I. III, 347. One that I shot on the borders of a mustard field in the factory compound had about a dozen caterpillars from 0. 5″ to 1. 25″ long in its gizzard (T. R. Cripps.) H. M. G. B. I. III, 345.

1486. *Gallinago solitaria.*—Indian Solitary Snipe. They feed chiefly on small insects and tiny grubs. "I have found a mass of minute black Coleoptera in the stomachs of two or three; of one I find noted minute shells. There is always a quantity of gravel or coarse sand in the gizzard.—H. M. G. B. I. III, 335. Insects and grubs. F. I. IV, 291.

1487. *Gallinago gallinula.*—Jack Snipe. Their food here consists of grubs and worms, and tiny insects, shells and crustacea, besides which a certain amount of green vegetable matter, minute portions of weed, club moss, and grass, as far as I could make out is occasionally found in their stomachs. I have never chanced to find any seeds, but it seems certain they do eat grass seeds at times in Europe and probably they do the same here.—H. M. G. B. I. III, 378.

1488. *Rostratula capensis.*—Painted Snipe. Exact record not forthcoming. I remember that insects and tiny crustacea and shells land and water predominated, and there were also grubs and caterpillars, and some admixture of vegetable matter, but I have also an idea that I repeatedly noticed grain and seeds of sedges and grass in their crops. Of this latter I cannot now be sure but I find that Hodgson notes finding both rice and fragments of mustard seeds in their gizzards, so that my remembrance is probably correct.—H. M. G. B. I. III, 385. Mainly on insects, grubs and mollusca, but also eat grain, seeds of grass, etc.—F. I., 4, 295.

Stomach examined—

15-10-09. A few small snails (No. 29.)

Of the *Limicolæ* most species are migrants as a rule visiting plains or the neighbourhood of the sea coast in the cold weather.

Œdicnemidæ and *Glareolidæ* are mostly plains residents. They are generally distributed, the various species haunting different localities, being found on dry plains, the sea shore, hill and forests tracts. Some are resident and some migratory.

The *Parridæ* or Jacanas are found in the neighbourhood of tanks and rivers in the plains of India and in Burma.

Charidriinæ or Plovers are mostly found in the plains as winter visitors, these migrants being more numerous in the North-Western portion of the Empire. Three or four species are residents in the plains, some extending into Burma. The members of the genus *Ægialitis* are all winter visitors to the plains, two species, however, being confined to the coast, namely, *geoffroyi* and *mongolica;* all are migratory.

Hæmatopodinæ.—The Oyster Catcher frequents the sea coast only, while the Stilts and Avocets are met with in various parts of India, the Ibis-bill even in hill tracts.

Totaniinæ.—All the Sandpipers (*Totanus*) are winter migrants to India, and though generally distributed are more numerous in the more Northern parts of India; one or two species are confined to the coast.

The Stints (*Tringa*) are most numerous on or near the coast. Some extend inland along river beds and all are winter visitors.

Scolopacinæ.—The Wood-cock and Wood-snipe breed in hill tracts—the Himalayas, the former occurring generally throughout hill tracts in India in the cold weather. Other snipes are mostly winter visitors, haunting wet or damp localities, and but rarely recorded as breeding on the plains. *G. solitaria*, however, haunts high lands and *R. capensis* is a local migrant.

This order is of considerable economic importance. The Plovers are certainly beneficial in one or two cases, but from a

food standpoint most are probably of little importance. Most are excellent eating, and the Snipes probably afford more in the way of sport than any other group of birds in India.

GAVIÆ.

Skuas, gulls and terns live chiefly on fish, and crustacea, a few on insects and others on carrion and refuse, and they either pick their prey off the surface of the water or plunge for it.—Jerd. B. I. III, 828. The food consists mainly of fish, molluscs, crustaceans and worms, but it is varied in the stronger forms by small mammals, young birds and eggs. Skuas give chase to their smaller kin and force them to disgorge the fishes they have just caught, while even solan geese are sometimes victimized. Insects and their larvæ, turnips, berries and grain are also eaten by these omnivorous but useful creatures. Their main sustenance is naturally derived from the ocean, or its oozy shores, but flocks are commonly seen on pastures and arable lands near the beech, or following the plough further from the sea.—E. B. C. N. H., 302.

Larinæ.—Gulls. Fish, worms and garbage thrown from ships.—Jerd. B. I. III, 829. They feed but little on living fish, chiefly on dead fish, crustacea, and garbage of all kinds floating or on the shore; and inland they eat insects and worms, eggs and weakly or young birds.—F. I. IV, 298.

1489. *Larus ichthyaetus.*—Great Black-headed Gull. Fish.—B. N. H. S. J. XV, 70.

1490. *L. ridibundus.*—Laughing Gull. Fish.—B. N. H. S. J. XV, 70. Occasionally feeds in newly ploughed fields.—Jerd. B. I. III, 832.

1491. *L. brunneicephalus.*—Brown-headed Gull. Fish.—B. N. H. S. J. XV, 70. Occasionally feeds in newly ploughed fields.—Jerd. B. I. III, 832.

1495. *L. cachinnans.*—Yellow-legged Herring Gull. Fish.—B. N. H. S. J. XV, 70.

Sterninæ.—Terns. Always seek their food while flying, occasionally plunging into the water for it, but generally seizing it off the surface; a few hunt over marshes and fields, and eat grasshoppers and other insects. They subsist chiefly on living prey especially fishes and many Terns also feed on crustacea or various floating animals that they scoop up from the sea, and others live to a great extent on insects.—F. I. IV, 306.

The food consists of fish and crustaceans, insects said sometimes to be taken on the wing—frogs, newts, locusts, grasshoppers, caterpillars, leeches, molluscs and medusæ.—E. B. C. N. H., 303.

1496. *Hydrochelidon hybrida.*—Whiskered Tern. Aquatic food, but not infrequently hunting over fields, etc., on grasshoppers, caterpillars and other insects.—Jerd. B. III, 837. Aquatic insect, varied by frogs, newts and small fish.—E. B. C. N. H., 837.

1498. *Hydroprogne caspia.*—Caspian Tern. Fish and prawns.—Jerd. B. I. III, 837; F. I. IV, 310.

1499. *Sterna anglica.*—Gull-billed Tern. Feeds alike on aquatic food, and on grasshoppers, beetles and other insects.—Jerd. B. I. III, 836. Aquatic food and insects.—F. I. IV, 312.

1501. *S. media.*—Smaller Crested Tern. Fish.—F. I. IV, 314.

1502. *S. bergii.*—Large Crested Tern. Fish.—F. I. IV, 314.

1503. *S. seena.*—Indian River Tern.

Stomach examined—

7-9-08 3 *Dragonflies. Beneficial insects.*

1506. *S. fluviatilis.*—Common Tern. Fish-eating exclusively.—F. I. IV, 318.

1509. *S. sinensis.*—White-shafted Tern.

1510. *S. minuta.*—Little Tern.

1511. *S. saundersi.*—Black-shafted Tern. The three small Terns feed chiefly on fish.—F. I. IV, 321.

1512. *S. melanauchen.*—Black-naped Tern. Fish.—B. N. H. S. J. XIII, 152.

1513. *S. anæstheta.*—Panayan Tern. Chiefly small fish and crustacea (whatever it can pick up from the sea).—F. I. IV, 324.

1514. *S. fuliginosa.*—Sooty Tern. Fish, cephalopods, and crustacea picked up from the sea.—F. I. IV, 323.

Anous.—The Noddies. Mollusca and fatty matter on the water.—Jerd. B. I. III, 845. Floating mollusca or dead fish or offal on the sea.—F. I. IV, 328.

Larinæ.—"The Gulls are sea birds as a rule, though many of them are found about rivers and marshes, and even inland far from water.....Many of them are migratory.....Seven species have been recorded on Indian coasts and rivers, but whilst all of these occur to the Westward in Sind, only four have been observed in the Bay of Bengal, and but two in Ceylon."

All species except *L. hemprichi* are migratory, visiting India in the winter. *L. hemprichi*, *L. gelastes*, and *L. affinis* are more confined to the sea coast than the other four species.

These birds no doubt do some damage by destruction of fish on which they largely feed when on the sea coast, but considering the numbers in which these birds occur, comparatively little damage is done, as the fish diet consists largely of dead fish, the birds therefore acting as scavengers. When inland their diet is somewhat different, and then consists to some extent of insects, but chiefly of carrion ; in one or two instances Gulls are undoubtedly beneficial, and notably *L. ridibundus*, when found inland feeding largely on injurious insects. If fish manure is used in any locality in which these birds are numerous, the manure must be spread and dug or ploughed in immediately, or it will be found that the greater proportion, if not all, of the manure will be taken off for food by these birds if left exposed on the land for even a short time.

The *Sterniæ* or Terns.

Sterniæ or Terns haunt different localities. Some seven species are entirely Sea-Terns, and these live for the most part on fish and are therefore possibly injurious to some extent. They live

much more on live fish than dead, and so their diet differs considerably from that of the Gulls. Of the species not generally found on the sea coast *H. hybrida* is an inland resident throughout India, *S. anglica*, *S. fluviatilis*, and the three Ternlets (*sinensis*, *minuta* and *saundersi*) are of general occurrence, and *S. seena* and *S. melanogaster* preferably frequent rivers.

The Terns are probably mostly migrants, going North to breed in the hot weather; the River Terns, however, breed in large quantities in India. The Terns do not appear to be of any beneficial importance, and need more or less specific distinction.

Rhynchops.—Small fish, crustaceans, etc.—E. B. C. N. H., 304.

1517. *Rhynchops albicollis.*—Indian Skimmer or Scissors Bill. Asserted to pick up small fish and crustacea but....I have generally discovered merely a little oily fluid.—Jerd. B. I. III, 847. Fish.—F. I. IV, 328. The skimmer haunts large rivers.

Stercorariidæ.—Skuas live chiefly by robbing other birds.—Jerd. B. I. III, 828. Rob Gulls, Terns and Petrels of their food.—A. le M., 230. Rob sea-birds of fish and other food. At times the Skuas feed on eggs, on young and sickly birds, and on some mammals.—F. I. IV, 328.

1518. *Stercorarius crepidatus.*—Richardson's Skua.

1519. *Stercorarius pomatorhinus.*—Pomatorhine Skua. Of both these species. "The food consists chiefly of fish, which the smaller Gulls are forced to disgorge, while Kittiwakes and the like are themselves devoured in default of other prey; .... Rob even Terns. E. B. C. N. H., 305. Skuas are sea-birds.

Steganopodes.—Pelicans, Frigate-birds, Cormorants, Gannets, and Tropic-birds. These birds are almost exclusively piscivorous, and are therefore generally regarded as injurious.

STEGANOPODES.

Pelecanidæ.—Pelicans. They live on fish, and when in flocks often capture their prey by forming in single, double or even triple line across a piece of water, and driving the fish before

them by beating the water with their wings. When the fish are driven into shallow water, the Pelicans scoop them up into their pouches.—F. I. IV, 333.

1520. *P. roseus.*—Eastern White Pelican. Clears whole tanks and "jhills" of fish.—Jerd. B. I. III, 856.

1523. *P. philippensis.*—Spotted-billed Pelican. Used by natives for catching fish of species of *Colisa* and *Anabas.*—Jerd. B. I. III, 860. Feeds young on water weeds.—B. N. H. S. J. XIV, 401.

Fregatidæ.—Frigate-birds. Live by piracy; do not confine themselves to fish taken by other birds; they often capture flying fishes, cuttle fishes, crabs or even young turtles.—F. I. IV, 338. Rob Gannets, Terns and Gulls of their prey.—A. le M., 240.

Phalacrocoracidæ.—Cormorants and Darters.

Phalacrocoracinæ.—Cormorants. Fish.—F. I. IV, 340. The food normally of fish is varied by crustaceans or even frogs and newts.—E. B. C. N. H., 78.

1527. *P. fuscicollis.*—Indian Shag. Trained for fishing.—Jerd. B. I. III, 863.

1528. *P. javanicus.*—Little Cormorant.

Stomachs examined—

13–2–07.
24–3–09.
26–5–08.
28–5–07.
1–6–08.
11–10–07.
11–10–07.

} All these birds contained remains of fish only.

Plotinæ.—Darters or Snake-birds.

1529. *Plotus melanogaster.*—Indian Darter or Snake-bird. Entirely fish.—Jerd. B. I. III, 866; and F. I. IV, 344.

Sulidæ.—Gannets, Solan Geese or Boobies. Fish. Tropical species very generally on flying-fish, but remains of cuttle fish have been found in their stomachs.—F. I. IV, 346. Surface swimming fish, squids and the like.—E. B. C. N. H., 75. It is

Conjectured that Gannets destroy more than 100,000,000 of herrings yearly.—A. le M., 238.

1530. *Sula leucogaster*.—Booby or Brown Gannet. Flying-fish.

Phaëthontidæ.—Tropic-birds. The food consists of fish, squids, and other produce of the sea.—E. B. C. N. H., 73.

1534. *Phaëthon flavirostris*.—White Tropic-bird. Flying-fish.—Jerd. B. I. III, 350.

Of the *Steganopodes* the Pelicans occur both on the sea and inland. The Cormorants are to be found in all well watered districts in India and Burma, one species only *P. carbo* being found commonly on the sea coast.

The Darter has an inland distribution similar to that of the Cormorants.

The remaining families, the Gannets, the Tropic-birds and the Frigate-birds are all entirely confined to the sea and ocean.

TURBINARES.

Petrels.

Petrels are birds of the ocean, passing the greater part of their time far from land. They feed on crustacea, mollusca, small fish, alive or dead, and similar aliment. Some of them, as the Fulmars and *Daption*, follow ships and feed on any refuse, especially fat, that may be thrown overboard.—F. I. IV, 352.

Putrescent fish and any other floating animal and oily matter.—Jerd. B. I. III, 826.

Procellariformes.—(Albatrosses and Petrels). "The food consists of fish, crustaceans, Cephalopods and other molluscs, jelly fish and the like. Albatrosses and Fulmars being said to force other species to part with their booty, after the manner of Skuas, or even to devour nestlings. Herbage is rarely found in the stomach, but blubber of dead animals and scraps thrown overboard are eagerly swallowed."—E. B. C. N. H., 62.

HERODIONES.

Herodiones.—Ibises, Spoonbills, Storks, Herons. Carnivorous, especially fish and are seldom used for food.—S. M. F. Z., 1908.

Sub-order : *Plataleæ.*

Ibididæ.—Chiefly aquatic insects, molluscs, crustaceans and worms ; but small fish, lizards, newts, frogs, grasshoppers and beetles form part of the diet.—E. B. C. N. H., 100.

1541. *Ibis melanocephala.*—White Ibis. Molluscs, crustacea, insects, worms ; in water.—Jerd. B. I. III, 768 ; and F. I. III, 362.

1542. *Inocotis papillosus.*—Black Ibis. It feeds chiefly on dry land. It eats beetles, crickets and all sorts of insects, occasionally crabs, prawns, and aquatic insects. Adams states it feeds on carrion ? Beetles, scorpions, etc. It is accused by the natives of consuming much grain.—Jerd. B. I. III, 370. Said to feed partly on grain, but chiefly on insects, crustacea, etc.—F. I. IV, 363. This bird is called the "planters' friend" by many Europeans on account of the number of crickets they kill in indigo fields.—B. N. H. S. J. XV, 13.

Sakri.

27-9-09. (A young bird).
7 *Brachytrypes achatinus.*
9 Forficulid claspers
*6 *Camponotus compressus.*
*1 *Polyrhachis simplex.*
1 *Onitis philemon.*
1 *Copris* sp.
*1 *Onthophagus dama.*
*1 *Onthophagus cervus.*
*1 *Onthophagus longicornis.*
*4 *Onthophagus gazella.*
*3 *Pheropsophus bimaculatus.*
*2 *Chlaenius marginatus.*
*1 *Chlœnius circumdatus.*
*1 *Chlœnius* sp. (Pusa No. 1825).
*1 *Macrochilus 3-pustulatus.*
*2 Carabids spp.
7 *Cybister confusus* larvæ.
75 *Hydrophilus* sp. larvæ.

Sakri—contd.

*1 *Opatrum* sp.
*2 *Opatrum depressum.*
17 *Agrotis* sp. larvæ (cutworms).
2 *Prodenia littoralis* larvæ.
1 *Sphæridium annulatum.* (Belostomid).
9 Small frogs.
4 Small fish.
1 Young paddy plant ?

27-9-09. 6 *Brachytrypes achatinus.*
1 *Onitis philemon.*
*8 *Onthophagus* spp.
*3 *Onthophagus gazella.*
*3 Aphodiids.
*1 Tenebrionid.
10 *Hydrophilus* sp. larvæ.
4 *Cybister confusus* larvæ.
25 Frogs.
1 Small fish.
2 Earthworms.

Summary.—Two birds took 141 insects, of which 32 are injurious, including 17 cut-worms, 109 neutral and 0 are beneficial. Both took frogs, which at this time of the year appear to be the main food and fish. One contained earthworms.

These records—not the summary—are of the total number of insects and animal food found in the stomachs of the two birds. But I do not believe that the Black Ibis is either capable of taking, or content to take, such small insects as some of those recorded. In the first record all the frogs were in a more than semi-digested condition, and therefore none of their stomachs could be examined. In the latter, however, 7 frogs were whole and had only just been eaten when the bird was shot. An examination of their food proved that they had fed entirely on small beetles, mostly *Onthophagus*, while a few Aphodiids and Tenebrionids were also present. We may therefore assume with certainty that the smaller insects food found in the bird's stomachs was derived from the stomachs of the frogs eaten. It is possible that the Carabids in the first record were taken by the bird, but they are often taken by frogs and were so most probably in this case. A star is placed against the insects in the stomach records to denote the insects which were almost certainly derived from the frogs, and these

insects have not been included in the summary. It is interesting to note that the *Cybister* and *Hydrophilus* larvæ averaged about 3 inches in length.

1544. *Plegadis falcinellus.*—Glossy Ibis. Frequents edges of tanks, etc., and feeds on insects, crustacea, mollusca, worms, etc. "Adams states it feeds on carrion, beetles, scorpions, etc., but I think he has confounded this bird with the last. (*I. papillosus*)."—Jerd. B. I. III, 771. Insects, crustacea, mollusca, worms, etc. F. I. IV, 365.

Plataleidæ.—Spoon-bills. Fish, frogs, crustaceans, molluscs, beetles, and insect larvæ.—E. B. C. N. H., 103.

1545. *Platalea leucorodia.*—Spoon-bill. Feeds in shallow water on various aquatic insects and larvæ, small crustacea and mollusca, and also frogs and fish. Jerd. B. I. III, 764. Insects, crustacea, worms, mollusca and on water plants, occasionally on fish and frogs.—F. I. IV, 367.

CICONIÆ.

Ciconiidæ.

Ciconia.—The Storks feed on insects, reptiles, fish and crustacea.—Jerd. B. I. III, 735.

1546. *Ciconia alba.*—White Stork. Grasshoppers, lizards, snakes, centipedes, etc. Often hawked by the Bhyri.—Jerd. B. I. III, 736. Insects, reptiles, fish.—F. I. IV, 369.

1547. *C. nigra.*—Black Stork. Chiefly aquatic food.—Jerd. B. I. III, 735.

"The Adjutants and true Storks are all more or less foul feeders, and in the East do much service as scavengers."—Watt. S. 2909.

1548. *Dissura episcopus.*—White-necked Storks. Grasshoppers, lizards, crabs and molluscs and aquatic insects.—Jerd. B. I. III, 737. Insects, reptiles, frogs, molluscs, crabs, fish, etc.—F. I. IV, 371. Large molluscs and frogs.

1549. *Xenorhynchus asiaticus.*—Black-necked Stork. Various water animals, fishes, and molluscs.—Jerd. B. I. III, 734. Like other Storks on fish, reptiles, frogs, crabs, molluscs, etc.—F. I. IV, 373.

Leptoptilus.—The Adjutants devour carrion of all kinds, as well as fish, reptiles, crustacea, etc., and serve the purpose of scavengers in some of our large cities.—Jerd. B. I. III, 729.

1550. *Leptoptilus dubius.*—Adjutant. In Calcutta and some other large towns, the Adjutant is a familiar bird unscared by the near approach of man or dog, and protected by law in some cases. It is an efficient scavenger attending the neighbourhood of slaughter-houses and especially burning grounds of Hindoos, where the often half-burnt carcases are thrown into the rivers. It is also diligently looks over the heaps of refuse and offal thrown out in the streets to await the arrival of scavengers' carts, where it may be seen in company with dogs, kites and crows. It likes to vary its food, however, and may often be seen searching ditches, pools of water and tanks for frogs and fish. In the Deccan it soars with Vultures ready to descend on any carcase that may be discovered. The Adjutant occasionally may seize a crow or a mynah, or even as related a cat.—Jerd. B. I. III, 731. Adjutants as useful scavengers are in many places protected by law. Their food, however, is not confined to carcases and offal, they live also at times on fish, reptiles and frogs like other Storks.—F. I. IV, 374. Adjutant is a Stork which has acquired the habits of a Vulture. Forsaking to a large extent frogs and such like delicacies, which constitute the normal diet of its kind, it lives chiefly on offal.—Dewar B. P., 29. Improved sanitary conditions have banished both offal and Adjutants from the city.—Imp. Gaz., I. 264. In the Daman a sort of field mouse (*Drui*), is often very destructive to the crops, and multiplies exceedingly till drowned out by the floods, or exterminated by the Adjutant and Cranes.—Punjab Gaz., Delhi. Dead Cow.—B. N. H. S. J. Russell. Viper.—B. N. H. S. J. XVII, 501. Eating carrion with Vultures.—

Bomb. Gaz., Vol. XX, 520. Eaten by Mohammedans.—B. N. H. S. J. XV, 75.

1551. *Leptoptilus javanicus.*—Small Adjutant. Fish, frogs and more especially crabs, and also on large locusts.—Jerd. B. I. III, 733. Fish, reptiles, locusts, crabs, etc.—F. I. IV, 375.

1552. *Pseudotantalus leucocephalus.*—Painted Stork. Fish, frog, or crab.—Jerd. B. I. III, 762. Usual habits of Storks.—F. I. I, 377. Feeds young on water weed.—B. N. H. S. J. XIV, 401.

1553. *Anastomus oscitans.*—Open-Bill. It lives chiefly on molluscs, especially on the large *Ampullaria*, but also on various others. Col. Sykes states that he found it feeding on a species of "Unio." "In default of its proper food, will eat fish, frogs, etc., but shell-fish are its peculiar aliment."—Jerd. B. I. III, 765. Chiefly on fresh-water mollusca, especially *Ampullaria*, and it is said *Unio*, and they occasionally eat fish, crabs, etc., but subsist mainly on mollusca.—F. I. IV, 378. Natives say they feed on dead bodies.—B. N. H. S. J. XVI, 15. Extracts *Unio* and other molluscs from their shells.—E. B. C. N. H., 97.

Ardeæ.

Ardeidæ.—Herons. They feed chiefly on fish, also on crabs, frogs, and a few on insects which they seek for on land among cattle.—Jerd. B. I. III, 738.

1554. *Ardea manillensis.*—Eastern Purple Heron. Fish, frogs, etc.—Jerd. B. I. II, 744. In the higher hills the streams have no fish, and very little insects or reptile life to form food for these birds.—B. N. H. S. J. XVII, 974.

1555. *Ardea cinerea.*—Common Heron. Chiefly fish: a favourite quarry for the Bhyri.—Jerd. B. I. III, 742. Chiefly small fish and frogs.—F. I. IV, 383. "The eel's foe, the Heron." *Ardea cineria.*—Dewar, B. P., 6. Stomach examined. 10-12-07 3 frogs.

1556. *Ardea sumatrana.*—Dusky-grey Heron. Small fish and crabs.—F. I. IV, 383.

1562. *Bubulcus coromandus.*—Cattle Egret. It always attends cattle whilst grazing and picks up grasshoppers and the larvæ disturbed by them; now and then it varies its food with small fish, tadpoles and aquatic insects.—Jerd. B. I. III, 750. This Egret is a constant attendant on cattle, either oxen or buffaloes, frequently perching on their backs and feeding mainly on the insects that are attracted by cattle, and on grasshoppers.—F. I. IV, 389. Leech or parasite off alligators? (*B. coromandus*), white Egret.—B. N. H. S. J. II, 224. Follows grazing cattle, "but like other Egrets it feeds also on fish and tadpoles."—Bombay Gaz., Ahmedabad, IV, 95.

Stomachs examined—

3-12-09.	1	*Chrotogonus* sp.
	9	Other grasshoppers.
	1	*Sternolophus quinque-pustulatus.*
	1	*Spodoptera mauritia* larva.
	2	*Agrotis* sp. larvæ.
	3	*Hyostola trochala* larvæ.
	34	*Sarcophagidæ.*
	2	*Muscidæ.*
	28	Earthworms.
19-12-09.	14	Grasshoppers (several species.)
	3	*Chrotogonus* sp.
	1	*Onthophagus gazella.*
	1	Carabid sp.
	19	*Sarcophagidæ.*
	3	Tipulid (?) larvæ.
	10	Earthworms.
19-12-09.		
	10	*Chrotogonus* sp.
	2	*Acridium æruginosum.*
	2	*Atractomorpha crenulata.*
	5	Remains of about five other grasshoppers.
	6	*Agrotis* sp. larvæ.
	2	Small Carabids.
	1	*Opatrum depressum.*
	24	*Sarcophagidæ.*
	12	*Muscidæ.*
	6	Remains of about six other flies, probably all Muscids.
	4	Earthworms.

Summary.—Of 166 insects taken by 3 birds, 3 are beneficial, 3 neutral and 160 are injurious.

1565. *Ardeola grayi.*—Pond-Heron. Its especial food is crabs. It will, of course, also eat fish, frogs, and various aquatic insects.—Jerd. B. I. III, 751.

It feeds chiefly on frogs and crabs, occasionally on fish, insects, etc.—F. I. IV, 394.

Stomachs examined—

14–1–08.	3 *Brachytrypes achatinus.*
	1 Grasshopper head.
	3 Small ants.
	1 Caterpillar ?
24–3–09.	1 *Atractomorpha crenulata.*
	2 Tryxalids.
	1 *Oxya* sp.
	1 Crickets leg.
	5 *Zygopterids.*
	1 *Crocothemis servillia.*
	17 Dragon-fly larvæ.
	1 *Pelogonus marginatus.*
	1 *Hyphoporus aper.*
	1 Dytiscid.
	Several broken elytra (Dytiscids ?) (4 spms.)
	1 Moth's antenna.
	2 Tabanidæ.
	1 Muscidæ.
	1 Small fish.
	1 Prawn.
4–4–09.	5 *Trithemis pallidinervis.*
	9 *Platygomphus dolobratus.*
	12 Zygopterids.
	One blade of grass or water weed.
7–9–08.	3 *Trithemis pallidinervis.*

Summary.—Of 76 insects taken by 4 birds, 52 are beneficial, 14 injurious, and 10 neutral, 3 birds took beneficial insects, 2 injurious and 2 neutral, 1 contained a fish, and a prawn, and another a blade of grass.

1567. *Butorides javanica.*—Little Green Heron. Crabs and other food.—Jerd. B. I. III, 753. Crabs, frogs, small fish, etc.—F. I. IV, 396.

1568. *Nycticorax griseus.*—Night Heron. Fish, frogs, etc.—F. I. IV, 398.

1569. *Gorsachius melanolophus.*—Malay Bittern. Feeding at night on fish, crabs, worms, etc.—F. I. IV, 399.

Ardetta.—Go out to feed at night on fish, frogs, water insects and worms, and about the sea-coast on crabs and other crustacea. Some occasionally feed during daylight.—F. I. IV, 400.

1572. *Ardetta cinnamomea.*—Chestnut Bittern. Fish. B. N. H. S. J. XIII, 153.

1573. *Dupetor flavicollis.*—Black Bittern. Shell and other fish and water insects.—B. N. H. S. J. XV, 77.

1574. *Botaurus stellaris.*—Bittern. Fish, frogs, water-insects, crustaceans and worms.—F. I. IV, 405.

Frogs, fish, etc., and it is recorded that a water rail entire was taken out of the stomach of one in Scotland.—F. I. III, 758.

The *Plataleæ* or Ibises and Spoonbills occur practically throughout India. They are mostly marsh loving birds and are probably of little importance, one species at any rate in some part of the year is considered beneficial, namely, the Black Ibis (*Inocotis papillosus*).

Ciconiæ or Storks occur throughout India, being perhaps less common towards the South. Of these birds the Adjutants, which have a somewhat different diet from that of other Storks, are regarded as being beneficial as they are good scavengers. "The Adjutants and true Storks are all more or less foul feeders and in the East do much service as scavengers." (Watt).

The *Ardeæ* comprising the Herons, Egrets and Bitterns occur in all parts of India, and are residents generally performing local migration according to food-supply. They are marsh birds essentially, one genus—*Lepterodius*—frequenting the sea-shores. Most feed on fish, frogs and such food as is to be found in shallow water, and are therefore not beneficial, while one or two of the Egrets, which at times obtain a certain amount of their food on dry land, are then beneficial, feeding as they then do very largely on grasshoppers.

PHŒNICOPTERI.

Phœnicopteridæ.—Flamingoes. They appear to feed on various minute animal and vegetable substances which they find in the soft mud of the lakes and salt water lagoons they frequent.—Jerd. B. I. III, 774.

Aquatic herbage, frogs, crustaceans, molluscs, and so forth.—E. B. C. N. H., 107.

1575. *Phœnicopterus roseus.*—Common Flamingo. It feeds on minute molluscs, small insects and crustacea, worms, etc., which it scoops up by its inverted bill. I have, however, generally found some mud in the stomachs of those I have examined. It also eats confervæ, and other soft vegetable matter, and in confinement, will eat bran mixed with water, boiled rice, etc.—Jerd. B. I. III, 776.

The food of Flamingoes consists, according to most authors, partly of small crustaceans, worms, and insects, with larvæ and ova, partly of vegetable matter, but Gadow says essentially of organic slime, confervæ.—F. I. IV, 409.

What they actually feed on is not at all well known—a considerable part of their diet is vegetarian, but they are also in all probability far more given to animal food than has generally been believed to be the case. Mr. Eagle Clarke. .... (Rhone delta) almost entirely, if not quite, on a tiny Phyllopod, the brine-shrimp (*Artemia salina*), which he states is found there in marvellous abundance.—S. B. I. D. A., 6.

Vegetarian largely: small phyllopod: shrimps (*Artemia salina*).—B. N. H. S. J. XI, 7.

ANSERES.

Swans, Geese and Ducks.

Fam. Anatidæ.

They feed on mud flats, and beds of such food plants as *Zostera* (Grasswrack). The usual food is vegetable consisting of

grass, *Chara*, *Zostera*, *Ulva*, and other plants.—E. B. C. N. H., 113-114.

Subfam. *Cygninæ*.—Swans. Swans feed on the seeds and roots of water plants and also on grass.—Jerd. B. I. III, 777. A. le M., 251.

1577. *Cygnus olor*.—Mute Swan. They feed chiefly on aquatic plants, partly on insects and their larvæ, molluscs, etc.—F. I. IV, 414.

1578. *Cygnus musicus*.—Whooper. These Swans are, If ancy, chiefly vegetarians, feeding mostly on herbs, and their seeds and sometimes flowers, weeds and grasses.—H. M. G. B. III, 48.

Their (*C. bewicki*) food, like that of other swans, seems to consist of seeds, stems, and corms of rushes, and various kinds of aquatic herbs together with perhaps worms and the larvæ of insects.—H. M. G. B. III, 52. Aquatic plants.—E. B. C. N. H., 135.

Subfam. *Anserinæ*.—Geese. True Geese feed entirely on vegetables, grazing on grass and young corn, their short stout bill being well suited for biting off the shoots.—Jerd. B. I. III, 778.

They generally feed on grass or other green vegetable food; some forms however feed on marine plants.—F. I. IV, 415.

Anser.—All Grey Geese feed chiefly by day among green corn, stubble, peas, beans or clover, retiring at night to sand banks, or mud flats in winter.—E. B. C. N. H., 132.

1579. *Anser ferus*.—Grey Lag Goose. The Grey Lag Goose is occasionally met with in vast flocks which feed on young corn, grass, etc.—Jerd. B. I. III, 779.

They feed exclusively, so far as my experience goes, on tender shoots of grass, young corn, and other spring crops, and on grain of all kinds—gram when nearly ripe being a great attraction to them. Three or four hundred of these birds will clear

off an incredible amount of grain in a morning.—H. M. G. B. III, 57.

Grass and green crops.—F. I. IV, 417. If there are any young crops of wheat in the district, the sportsman should be out before daybreak, and he may then get within easy shot of the birds as they feed on the young growth. Geese are almost invariably vegetarians, and get their food by grazing, in which way large flocks will do immense damage to young crops in a single night. They are destructive birds also, owing to the fact that they pull so much of what they feed on up by the roots and thus destroy what they do not eat.—S. B. I. D. A., 69.

1580. *Anser albifrons.*—White-fronted Goose. It is stated to frequent marshes and rarely to visit cornfields.—Jerd. B. I. III, 781.

The specimens I killed had fed entirely on some species of wild rice, and on tender green shoots of some grass or grain.—H. M. G. B. I. III, 75.

1581. *Anser erythropus.*—Dwarf, or Lesser White-fronted Goose.

Food similar to that of other Geese—grain and green shoots.—H. M. G. B. I. III, 78.

1583. *Anser indicus.*—Barred-headed Goose. It grazes on the river banks and fields of corn, chenna, etc.—Jerd. B. I. I, 783.

As soon as the crops are cut and carried and the stubbles have been pretty well gleaned, they disappear. They feed in fields, browsing on the young wheat or waddling among the heavy clods, amidst which the gram grows, to devour the young shoots, or later the ripening pods of this vetch. All vetches, lentils, grain, tender grasses, and herbs, seem equally to suit their taste, and so long as these are available they eat nothing else.—H. M. G. B. I. III, 84.

The usual habits, feeding on grass and crops of wheat, barley, gram, etc.—F. I. IV, 420.

They are, of course, almost entirely vegetable feeders, and it is wonderful what damage a flock can do to young crops even in a single night; and where they are numerous they take no

small percentage of the wretched villager's winter crops. They will eat almost any young tender green stuff, but probably prefer the late rice crops to any other.—S. B. I. D. A., 87.

SUB-FAMILY: *Anatinæ*.—Typical ducks, Sheldrakes, etc.

1584. *Sarcidiornis melanonotus*.—Comb Duck or Nukta. Go to paddy-fields to feed on the grain. (Theobald). Their food consists chiefly of tender shoots and seeds of aquatic herbage, worms, larvæ of water insects, small shells, fresh water crustacea and occasionally a tiny fish or two. They do not visit, as a rule, or rob our fields much in Upper India; I have never found any grain, but wild rice seed, in their stomachs and only once or twice have I seen them browsing on the turf near the water's edge. "At night they roam over the paddy stubble, and I have found their stomachs full of rice during the harvest." (Tickell).—H. M. G. B. I. III, 91-96.

Though Hume never found any grain except wild rice in the stomachs of the birds he examined, others, besides Tickell, have found that cultivated rice forms one of the articles of their diet. They eat all sorts of shoots, roots, seeds, etc., of water plants, varying this vegetarian food with a little animal stuff now and then, such as worms, spawn, larvæ, and perhaps an occasional fish.—S. B., 9, 27, 28.

1585. *Asarcornis scutulatus*.—White-winged Wood-Duck.

"My birds were practically omnivorous, but would touch no dead animal food." Small fish, worms, grasshoppers, frogs, and snails only eaten if alive. Paddy and husked rice, but preferred animal food to grain. "Green food of all sorts they refused unless very hungry, and I could never induce them to eat any sort of water weed."—S. B. I. D. A., 38.

1586. *Rhodonessa caryophyllacea*.—Pink-headed Duck.

(Shillingford) Half-digested water weeds and various kinds of small shells.—H. M. G. B. III, 176.

Referring to the above "this is important, however, as it shows that it is both an animal and a vegetarian feeder."—S. B. I. D. A., 46.

1587. *Tadorna cornuta.*—Sheldrake.

All those I have examined had fed chiefly on land and water shells, and fresh-water shrimps of kinds,—but also contained some green vegetable matter and a quantity of coarse sand.—H. M. G. B. III, 136.

Their food appears to be mainly animal and consists of shell-fish, water-insects, prawns, and shrimps, and practically all or any of the small animal life found on the shores at low tide or in shallow water. A small amount of vegetable matter is doubtless eaten now and then, but merely as one takes vegetable with a meat diet.—S. B. I. D. A., 111.

Aquatic plants, molluscs and insects.—E. B. C. N. H., 128.

1588. *Casarca rutila.*—Ruddy Sheldrake or Brahminy Duck.

Grazes in the young cornfields just like Geese; it also picks up seeds of grass, grain, etc. A writer in the *Indian Sporting Review* for 1854 states, that "it is often found devouring carrion on the banks of rivers."—Jerd. B. I. III, 792.

No doubt they will graze on young grass and corn when this comes down to the water's edge, and in jhils gobble up various kinds of water weeds and seeds, but tiny fry of fish, shrimps and all kinds of small land and water shells have proved the chief food of those I have examined. On the Jumna I continually found their stomachs half full of small spiral univalve shells; tame ones I had were fed upon tiny frogs, and though they are decidedly omnivorous, and do at times eat grain and green shoots of all kinds, I think that in India at any rate the animal element predominates in their diet.

It has also been charged against them that they feed on carrion. Mr. Rainey writes—"I have heard from several sportsmen that it is a foul feeder, and I myself on one occasion, in 1868, actually saw it eating carrion."—H. M. G. B. III, 128.

They are very carnivorous and will take almost anything they can get, including fish, flesh, and all kinds of grain, water-weeds, seed, and growing crops, in which they are sometimes found grazing like Geese. There can be little doubt also that they sometimes fall so low as to take offal.—S. B. I. D. A., 130.

It feeds partly on grass or crops like Geese, partly on molluscs and crustacea.—F. I. IV, 429.

Grazes on corn and grass like a Goose.—E. B. C. N. H., 129.

Feeds often on grain inland in large flocks.—*Punjab Gaz.*, Ludhiana, 15.

Dendrocycna.—In winter the flocks cause great damage to corn or rice near the lagoons, and other waters they frequent.—E. B. C. N. H., 130.

1589. *Dendrocycna javanica.*—Whistling Teal.

Feeding like Geese on short fine grass, and Mr. Cripps says—"This species is often seen on freshly ploughed paddy-fields, evidently feeding on the grains of paddy that have been left above ground after sowing." They are chiefly, I think, vegetarians, and devour rice especially, wild and cultivated, most greedily, but they also feed on all kinds of seeds, rushes and other water plants, the herbage, bulbs and corns of these and on grass, and at times small shells, worms and a variety of insects are found in their stomachs. Once I shot one that disgorged as it fell, a tiny silvery fish about two inches in length. But as a general rule (and I have dissected many), they feed principally, I believe, on vegetable substances.—H. M. G. B. III, 111-112.

They feed on anything and everything, but bring up their young principally on animal food, and they themselves, in the adult state, probably prefer vegetable food. They graze often in the rice-fields, but only when the plant is very young, and I have seen them grazing on the coarse dhub-grass which often grows on sandy spots at the edges of tanks and jhils in the cold weather. I have found that they eat large quantities of a very small fresh-water snail.—S. B. I. D. A., 103.

1590. *Dendrocycna fulva.*—Large Whistling Teal.

Their food during the cold season consisted mainly of rice, but they are very miscellaneous feeders, and I have found in their stomachs, not only all kinds of aquatic seeds, bulbs, leaf-shoots, and buds, grass and rush, but small shells, insects, worms, and larvæ, and on one occasion a tiny frog. Still, grains of rice, wild and cultivated, constituted the bulk of their food.—H. M. G. B. III, 121.

These duck or teal are practically as omnivorous as is the domesticated duck, and will eat almost anything they can get hold of, preferring perhaps a vegetarian to a meat diet.—S. B. I. D. A., 96.

1591. *Nettopus coromandelianus.*—Cotton Teal.

Rice grains, especially the seed of the wild rice known as "Pasiæ" in Upper India, and of the shoots of various kinds of aquatic plants, water-insects, and their "larvæ." Minute fishes and fresh-water crustaceans?—H. M. G. B. III, 104.

1592. *Anas boscas.*—Mallard.

(Macgillivray) "Seeds of Gramineæ and other plants, fleshy and fibrous roots, worms, mollusca, insects, small reptiles, and fishes are the principal objects of its search."—H. M. G. B. III, 154.

Chiefly on vegetable food, though it occasionally feeds on crustacea, mollusca, frogs, or fish.—F. I. IV, 436.

1593. *Anas pœcilorhyncha.*—Spotted-billed Duck.

They are very miscellaneous feeders, and I have found worms, small frogs, and insects and their larvæ in their stomachs; but grain (wild rice by preference), and all kinds of rush, grass and water-plants and their roots, constitute the bulk of their food, and "I have often examined birds that had fed on vegetable matter only."—H. M. G. B. III, 167.

They are principally vegetable feeders, and do a good deal of damage to rice, both when young and when in the ear, trampling down a great deal more than they eat; they also, at times, eat

all sorts of miscellaneous food, such as water-mollusca, frogs, worms, insects.—S. B. I. D. A., 136.

Their food differs little from the mallard.—F. I. IV, 438.

Stomachs examined—

12-1-08. A few small water snails (*Vivipara crassa ?*).
12-1-08. One small water snail, and some vegetable matter.
12-1-08. 1 Frog.
3 Small snails. (*Vivipara crassa ?*).
Some vegetable matter.

1594. *Eunetta falcata.*—Crested or Falcated Teal.

Radde tells us "that the stomachs of some he shot on the 13th April just after their arrival, contained nothing but fragments of quartz and a few shoots of plants."—H. M. G. B. III, 232.

Its diet seems to be principally, if not wholly, vegetarian.—S. B. I. D. A., 146.

1595. *Chaulelasmus streperus.*—Gadwall.

With us their chief staple food, so long as they can get it is wild rice (though in some parts they feed in cultivated rice fields largely), and later the seeds, leaves and flower buds of all kinds of rushes and aquatic plants. Insects and their larvæ are also largely consumed, and sometimes small worms.—H. M. G. B. III, 183.

Food similar to the mallard.—F. I. IV, 441.

Almost entirely vegetable feeders, subsisting much on wild and cultivated rice, water-weeds, etc., and seldom varying their diet with animal food. A drake shot in Silchar was found to contain a mass of small white worms in addition to some water berries and half ripe rice.—S. B. I. D. A., 151.

Comes at night in huge flights to feed on the weeds in the nala.—*Punjab Gaz.*, Ludhiana, 15.

1597. *Nettium crecca.*—Common Teal.

(Theobald). "They feed mainly on the tender shoots of weeds and grasses." "Their feeding places are always the swampy margins and weedy shallows of broads or sluggish streams." There they feed on wild rice, grasses of all kinds, and their seeds, and all sorts of tender shoots, roots, corms, and bulbs, as

well as insects and their larvæ, tiny shells and worms. But this animal food forms but a small proportion of their diet here; indeed no traces of it have been visible in numbers that I have examined, and in captivity they thrive *à ne pouvoir plus* without it (which some of the larger ducks do not), and so I am inclined to grade them as essentially vegetarians.—H. M. G. B. III, 212.

They feed chiefly on plants.—F. I. IV, 444.

Their food is undoubtedly mainly vegetable, but they do not despise worms, insects, etc., which may come in their way.—S. B. I. D. A., 172.

1598. *Nettium albigulare.*—Andaman Teal.

Paddy-fields to feed.—H. M. G. B. III, 244.

1599. *Mareca penelope.*—Widgeon.

"With us in the N.-W. Provinces they are more purely grass-eaters than any other duck." Grass chief food, mingled with this a few fresh-water shells, insects and roots, and the leaves of rushes and aquatic plants, and a little grain. "I have often seen them on land grazing like Geese." Along the coast on all kinds of shell-fish, shrimps and the like, as well as on vegetable matter (green seaweed ?) of various kinds.—H. M. G. B. III, 200.

Graze like Geese; feed on grass, aquatic plants, insects, crustacea, and mollusca.—F. I. IV, 447.

Of two birds shot in Silchar, the stomachs contained nothing but the white tendril-like roots of a small water plant which grows profusely where the water is only a few inches deep.....They graze a good deal, like Geese, on young grass, and also young crops, and in addition to various other vegetable substances, eat water snails, worms, insects and shell-fish of sorts. Morris writes:—"This species feeds principally on water-insects and their larvæ, small mollusca, worms, the fry of fish, and frogs as also the buds, shoots and leaves of plants and grass, and these it browses on in the daytime."—S. B. I. D. A., 158.

Chiefly on grass-wrack and the like on mud-flats in winter.—E. B. C. N. H., 126.

1600. *Dafila acuta.*—Pintail.

Their food is very varied, although, like most of our fowl, wild rice, so long as it lasts, is their staple. But besides this, worms, small shells both land and water, grass and aquatic plants, bulbous roots and corn, and insects of all kinds are found in their stomachs. I think that with us they must particularly affect shells, because in no less than three cases out of twenty-two I have noted "stomachs almost entirely full of small fragile fresh-water shells," and in five others I have recorded shells as amongst the food found on dissection in the gizzards.—H. M. G. B. III, 192.

They feed mainly at night on vegetable food chiefly but also on mollusca and insects.—F. I. IV, 449.

Their food seems mainly to consist of small and fragile shell fish, but they also eat a large variety of other animal matter, and are also to a certain extent vegetarians.—S. B. I. D. A., 184.

1601. *Querquedula circia.*—Garganey or Blue-winged Teal.

"Weedy tanks are preferred by this teal. They live on the tender weeds and grasses." (Theobald). Come in some parts of the country in such crowds into paddy-fields as to destroy acres of crop at one visit. Their food is chiefly vegetable; tender shoots and leaves of water plants, seeds and bulbs and corms, and slender rhizomes of rushes, sedges and the like form the bulk of their diet to which at times large quantities of rice, wild and cultivated, must be added. Besides this they eat occasionally all kinds of insects and their larvæ, small frogs, worms, fresh-water shells, and the like; but, as a rule, this forms inland in India a very small proportion of their food, and no traces of anything but vegetable matter have been observable in the stomachs of many I have examined. On the sea coast it is different. There I found shrimps, delicate shells, and other animal substances in abundance in their gizzards.—H. M. G. B. III, 218.

The food of this teal is chiefly vegetable.—F. I. IV, 451.

They feed in the smaller tanks and jhils, and also in the paddy-fields, and on various young land-crops....Their staple diet

is vegetarian, and of vegetable matter the staple articles are rice both cultivated and wild, various kinds of reeds, roots, etc., and such animal matter in the shape of worms, snails and shell-fish, etc., which force themselves on their notice. The food of the Garganey is both vegetarian and animal, and it subsists much on surface buds of water plants, and shoots of such as run along the surface of the water. It however also eats water-insects, worms, and similar food.—S. B. I. D. A., 192-194.

Stomachs examined—

18-4-09.	4 Small shells and the remains of about seven more (*Planobis* sp.)
	8 Bulbous water weed roots.
	1 Small stone.
	A large amount of sand.
18-4-09.	1 Small pointed shell. (*Melania tuberculata*).
	2 Larger snail shells. (No. 16).
	4 Bivalves, opercula of *Vivipara?* or *Ampullaria?*
	2 Small black seeds.—(Cf. snipe).
	7 Large piece of a leguminous weed.

Summary.—Both birds contained shells and vegetable matter.

1602. *Spatula clypeata.*—Shoveller.

Feeding near the edges of tanks in shallow water among weeds, chiefly on minute worms and larvæ, which it sifts from the mud.—Jerd. B. I. III, 797.

Doubtless in more savoury localities, such as the more aristocratic Ducks frequent, insects and their larvæ, worms, small frogs, shells, tiny fish, and all kinds of seeds and shoots of water grasses, rushes and the like, constitute their food; but when they take up their abode on one of these .... it is impossible to say what they will not eat.—H. M. G. B. III, 143.

It is almost omnivorous, but feeds principally on insects and their larvæ, worms, molluscs, and on various organic substances that are found on the borders of swamps and ponds.—F. I. IV, 453.

As noted by Hume, they feed with bills and heads under water, ... collecting the numerous forms of animal life which abound, and .... They are omnivorous, and will eat almost any-

thing, but at the same time, animal food undoubtedly forms the major portion of their diet.—S. B. I. D. A., 199.

The diet includes herbage, worms, molluscs, crustaceans and insects.—E. B. C. N. H., 124.

1603. *Marmaronetta angustirostris.*—Marbled Duck.

"(Favier.) In Tangiers they feed on winged insects; in Sind the major portion of their food consists of leaves, shoots, rootlets, corms and seeds of aquatic plants, intermingled with worms, fresh-water shells, insects of all kinds and their larvæ." Frog.—H. M. G. B. III, 239.

"Its food is practically omnivorous."—S. B. I. D. A., 205.

Netta.—Teal feed chiefly at night on water-plants, seeds, worms and insects.—E. B. C. N. H., 126.

1604.—*Netta rufina.*—Red-crested Pochard.

Although mainly vegetarians, they indulge more on animal food than the Pochard. I have found small frogs, fish-spawn, shells, both land and water, insects, grubs, and on three or four occasions tiny fish, mixed with the vegetable matter, sand and pebbles that their stomachs contained. Usually at least two-thirds of their food is vegetable, leaves, stems; fleshy rhizomes, rootlets, etc., of arrow-grasses, *Sagittarias*, Horn-worts, and the like; but at times they feed largely on the animal substances above enumerated, and I examined one male that had entirely gorged itself on fishes about an inch in length." They graze, and pick up small shells and insects at the water's edge.—H. M. G. B. III, 258.

Its food is chiefly vegetable, though it feeds largely on insects, worms, frogs and fish.—F. I. IV, 458.

In the centre of huge bhils, "feeding on and amongst the aquatic plants, especially on a long trailing, moss-like weed which grew several feet under water. Moreover, I have found in their stomachs the roots of plants which do not grow except in fairly deep water." Food mostly aquatic, yet they have been known to feed on young crops on dry land. Naturally they are principally

vegetable feeders, ... but they feed on fish, shell-fish, and water-insects. Hume found one that had gorged itself on fish about an inch in length and I dissected one that had eaten, as far as I could see, nothing but the tiny red crabs which swarm in such countless myriads along the shores of rivers, swamps,'' etc —S. B. I. D. A., 212.

Nyroca.—The majority .... feed at dawn or dusk on aquatic plants and seeds, molluscs, insects, and even small fish and frogs, chiefly obtained by diving.—E. B. C. N. H., 123.

1605. *Nyroca ferina.*—Pochard or Dun-Bird. Dive for the roots and submerged stems and foliage of all kinds of aquatic plants...in Upper India...almost entirely vegetable. I have found a few insects, grubs, worms, tiny frogs, and a good many shells in their stomachs, but seeds, flower buds, shoots, leaves, stems and roots of water plants, together with fine pebbles and sand of which there is always a considerable quantity, have always constituted the bulk of the contents of these. One examined '' proved to have fed chiefly on marine plants, small crustacea and mollusca.—H. M. G. B. III, 249. They feed largely by night but also in the day, and obtain much of their food, which is chiefly vegetable, by diving.—F. I. IV, 459. Their bad flavour is, of course, due to their food, which when they take to the sea-shore, consists of tiny marine shell-fish, fishes, etc.; whereas, when in fresh water it consists mainly of a vegetable diet, though, like all ducks, they are more or less omnivorous. Principally night feeders. Hume once or twice caught them feeding on wild rice land, but nearly all their diet is one obtained from fairly deep water amongst roots and similar things.—S. B. I. D. A., 220-221.

1606. *Nyroca ferruginea.*—White-eyed Duck. They are with us quite omnivorous; no doubt their food chiefly consists of vegetable matter, leaves, stems, roots and seeds of grass, rush, sedge and all kinds of aquatic herbage; but besides this I have noted at different times, amongst the contents of their stomachs, delicate fresh-water shells and shrimps, insects (including several species

of Neuroptera and Lepidoptera) and their larvæ, worms, grubs and small fishes.—H. M. G. B. III, 269. Practically omnivorous, like most ducks, it appears to feed to a considerable extent on insects and their larvæ, crustacea and mollusca.—F. I. IV, 461. Omnivorous, like all ducks, this species probably makes its diet fully $\frac{3}{4}$ animal. Those birds which I shot in the Diyang and other hill streams had all (in addition to the Caddis grubs, dragon fly larvæ, and similar articles) quite a number of small fish, some of them three inches in length. These were nearly all of the "millers thumb" species, so common in every hill-stream.—S. B. I. D. A., 230.

1608. *Nyroca marila.*—Scaup. Feed on mud flats; although in a wild state, it feeds chiefly on marine mollusca, yet it soon accustoms itself to feeding on vegetable matter, and will freely eat grain, especially barley.—H. M. G. B. III, 273. Derives its name from feeding on mussels.—F. I. IV, 463. The food of the scaup is everywhere chiefly of an animal character. Inland, doubtless, it feeds to a certain extent on water weeds, etc., these being mainly such as grow at some depth and are obtained by diving; but even here shell-fish, frogs, insects, form the greater part of its diet. When in its natural element, on sea in creeks, or along the coast, it is almost entirely an animal feeder, subsisting on shell-fish, small fish, and other marine small life. Its name is derived from its habit of feeding on mussels.—S. B. I. D. A., 237.

1409. *Nyroca fuligula.*—Tufted Duck. It feeds on water insects and mollusca.—Jerd. B. I., III, 815. Their food is perhaps more animal than vegetable. They constantly devour small fish, and one finds every kind of water-insects, worm, grub and shells, small lizards, frogs, spawn, etc., in their stomachs. Still, like the rest they eat leaves, stems and roots of water plants freely, and I have several notes of birds which had dined (or breakfasted) entirely off some white shining onion-like bulb.—H. M. G. B. III, 281.

Their food appears to be largely animal, though of course they feed partly on vegetables.—F. I. IV, 464.

Its food is almost entirely animal, much the same, in fact, as the scaup, but it is far more a fresh water-bird, and far less a sea bird than is that duck.—S. B. I. D. A., 243.

1610. *Clangula glaucion.*—Golden-eye.

(Macgillivray) Their food consists principally of the larvæ of aquatic insects, for which they dive in the clear water.....They also feed on small fresh-water mollusca ; but I have not observed any vegetable substances in their œsophagus or stomach.....In one instance I have seen remains of small fishes in the gizzard. ....Especially in frosty weather, resort to estuaries, as well as the open coasts, where they procure testaceous mollusca, crustacea and fishes. (Yarrel.) Principally of small fishes.—H. M. G. B. III, 286.

The stomach contained fish weeds and seed. It is said to feed on "Testaceous mollusca, crustacea and fishes", also on water insects and grubs, and, but not often, also on vegetable food, principally deep-water weeds, roots and similar articles. Food consists almost entirely of animal matter procured by diving.—S. B. I. D. A., 249-252.

Erismatura.—The food is of fish, molluscs, and insects.—E. B. C. N. H., 118.

1611. *Erismatura leucocephala.*—White-headed Duck.

They are said to feed on water insects, small fishes, and shells as well as vegetable matter ; but I suspect that this is rather conjectural.—H. M. G. B. III, 291.

Sub-family: *Merginæ.*—Mergansers live chiefly on fish, but the bill of fare is varied by grain, pulse, berries, frogs, insects, larvæ, worms, molluscs, and crustaceans.—E. B. C. N. H., 114.

Their food consists of little but fish.—E. B. C. N. S., 116. Chiefly on fish.—Jerd. B. I. III, 817.

1612. *Mergus albellus.*—Smew.

Fish, crustacea and water-insects.—Jerd. B. I. III, 819.

They feed entirely under water. I have examined many without ever finding any vegetable matter in their gizzards, or anything but small fish and water-insects, chiefly a kind of cricket (?) and these they pursue under water.—H. M. G. B. III, 297.

Its food, chiefly fish and water-insects, is obtained by diving.—F. I. IV, 468.

(Hume) Fish. Its food is practically entirely animal, and consists of crustacea, molluscs, water-insects, larvæ, small fishes, etc.—S. B. I. D. A., 265.

1613. *Merganser castor.*—Goosander.

The great bulk of their food is fish, good-sized ones, often five or six inches long, and as in the case of the smew, there are always plenty of pebbles in their gizzards. I have found a kind of crayfish and water-insects in some I have examined.—H. M. G. B. III, 304.

Fish.—F. I. IV, 470.

As purely an animal diet as that of any duck in existence, and the greater portion of it consists of fish....Very often flocks will work in concert in their fishing....and....will almost exterminate a shoal. They are most voracious birds and do a great deal of damage in fishing rivers. Mr. E. T. Booth, in "Rough Notes," writes: "After a shot .... at a number of these birds .... scores of small rudd and roach were discovered lying on the surface where the flock had been resting." Mr. Finn in the *Asian:* "A captive I had under observation devoured no less than forty fish, about two inches long, at a meal."—S. B. I. D. A., 275.

The *Anseres* comprise a very important group of birds. Not only are many species kept domestically for the value of their products, but many of the wild species form a large natural food supply for man.

They are to a very large extent migrants and therefore we cannot regulate their occurrence in any one district except by

almost complete extermination. Many do an enormous amount of damage to young growing crops chiefly cereals.

The three main divisions are the Swans, the Geese, and the Ducks.

The Swans are by no means of general occurrence in India in fact being rare birds, and therefore of no agricultural importance. They certainly never appear in numbers worth consideration.

The Geese without exception appear to do a great deal of damage to grain and other crops ; and this is not only due to the fact that they feed on the grain and young growth, but they also pull up the young plants, so preventing all chance of any after-growth which would result if only the leaves were eaten off. Considerable damage is also done by treading down the crops affected.

Ducks.—We have nothing definitely on record about the food of ducks except in a generalized way. It is, however, evident that little, if any, benefit is derived from them as far as their feeding qualities are concerned. We can class none as beneficial, most will at present come under the neutral heading and some are apparently injurious to a greater or less extent. Amongst the latter group we may specially mention the "Garganey" or "Blue-winged Teal" (*Querquedula circia*), the "Whistling Teal" (*Dendrocycna javanica*), and the "Spotted-bill Duck" (*Anas pœcilorhyncha*), all of which are said to do a great deal of damage at times in paddy-fields. One or two other species also feed on paddy to a minor extent, especially "the large Whistling Teal" (*D. fulva*), the "Widgeon" (*Mareca penelope*), the "Gadwall" (*Chaulelasmus streperus*), the "Cotton Teal" (*Nettopus coromandelianus*), and the "Brahminy Duck" (*Casarca rutila*), the two first being of the most importance, and many species feed on young crops generally.

It is also well to note that those species which are injurious to crops are the best for food.

Large numbers of Ducks are kept over in the hot weather in 'Tealeries,' see Hume and Marshall, III, 209.

The members of the genus *Merganser* feed almost entirely on fish, and therefore possibly do some damage locally.

Ducks of most species are obtained for the markets in great numbers and it is questionable as to whether the benefits derived from these local industries counterbalance the value of the crops destroyed. Some beneficial action may be attributed to them because they eat snails, etc., to a great extent and in most cases water-insects (some of these however may be beneficial).

With regard to the benefits derived from the sport in connection with ducks and geese what has already been noted under the heading of game birds (*Phasianidæ*) equally applies to this group and also to the Snipes.

PYGOPODES.

Podicipdiæ.

The Grebes frequent ponds, etc., feeding on various insects, crustacea, young fish, etc. They frequently swallow feathers.—Jerd. B. I. III, 820.

All Grebes have a habit of eating their own feathers. No stones are found in the gizzard and the feathers apparently are a substitute.—F. I. IV, 473. A. le M., 287 (part).

Fish when procurable, small reptiles, amphibians, molluscs, crustaceans, insects and vegetable matter, feathers.—E. B. C. N. H., 54.

1615. *Podicipes cristatus.*—Great Crested Grebe.

Fish: when confined ... it took ordinary fish readily (I have seen it eat a dozen as large as large sprats and thicker, and then want more). It did not seem to like prawns, nor would it eat a small siluroid fish which I offered. On a few occasions I saw it deliberately eat one of its own feathers.—A. S. B., 66-726.

Young on fish.—B. N. H. S. J. XVII, 515.

1616. *Podicipes nigricollis.* Eared Grebe.

Feed freely on small prawns and fish.—A. S. B., 66-727.

1617. *Podicipes albipennis.* Indian Little Grebe, or Dabchick.

It hunts insects and crustaceans when at large, as well as fish and appreciated a varied diet of these when in captivity.—A. S. B., 66-729.

In captivity "before turning out .... refused a sharp toothed goby; it took however a spider and some mole crickets, small fish, crustacea; larvæ of water-insects, etc."—Jerd. B. I. III, 823.

III. SUMMARIES.

Vegetable diet of birds.

Fruit-eating birds are extremely numerous, though in most cases wild fruits only are taken. Practically all frugivorous birds eat the fruits of the common wild *Fici*, and it is possible that where figs (*Ficus cunia*) are cultivated, some of these birds may take them, but we have no records of any such kind. Those birds most likely to do so are the Barbets, Orioles and Mynahs.

Records from the hills are few, and it is from the hills that we would most expect records of damage to fruits. Of the plains birds the Rose-ringed Paraquet is a very general pest; the habits of this bird are discussed on page 188. Few other birds are of any importance with regard to their fruit-eating propensities, though at times White-eyes and Flower-peckers do no little damage to mangoes, etc. Fruits of various sorts in orchards are frequently damaged by the Tree-pie, by Bulbuls of various species, and by Barbets.

The following is a list of cultivated fruits with the birds at present recorded as taking or damaging them :—

Apples. (*Pyrus malus*).	*Loxia.*
Pears. (*Pyrus communis*).	*Dendrocopus auriceps.*
Apricots. (*Prunus armeniaca*).	*Palæornis schisticeps.*
Cherries. (*Prunus avium*).	*Corvus splendens.*
	Hypsipetes psaroides.
	Mycerobas melanoxanthus.
Peaches. (*Prunus persica*).	*Dendrocitta rufa.*
	Molpastes bengalensis.
	Thereiceryx zeylonicus.
Guavas. (*Psidium guyava*).	*Zosterops.*
	Dicœidæ. (*D. erythrorhynchum.*)
	Loriculus vernalis.
Pomegranates. (*Punica granatum*).	*Palæornis schisticeps.*
	Molpastes bengalensis.
Jack Fruit. (*Artocarpus integrifolia*).	*Corvus splendens.*

Litchi. (*Nephelium litchi*).	*Palæornis torquatus.*
	Eudynamis honorata.
Loquats. (*Eriobotrya japonica*).	*Dendrocitta rufa.*
	Molpastes bengalensis.
	Thereiceryx zeylonicus.
Mangoes. (*Mangifera indica*).	*Zosterops.*
	Dicæidæ. (*D. erythrorhynchum*).
Grapes. (*Vitis vinifera*).	*Treroninæ.*
	Carpophaginæ.
Cape Gooseberries. (*Physalis peruviana*).	*Molpastes hæmorrhous.*
	Trocalopterum cachinnans.
	Merula simillima.
Plantains. (*Musa sapientium*).	*Dendrocitta rufa.*
	Dryonastes ruficollis.
	Molpastes bengalensis.
	Bichoceros bicornis.
	Psittaci.
	Otididæ.
Oranges. (*Citrus aurantium*).	*Chloropsis hardwickei.*
Raspberries. (*Rubus idæus*).	*Molpastes burmanicus.*
	Gennæus melanotus.
Strawberries. (*Fragaria vesca*).	*Molpastes hæmorrhous.*
	Otocompsa emeria.
	Acridotheres tristis.
Watermelons. (*Citruttus vulgaris*).	*Grus communis.*
Mulberries. (*Morus indica*).	*Corvus macrorhynchus.*
	Corvus splendens.
	Pyrrhocorax alpinus.
	Dendrocitta rufa.
	Hypsipetes psaroides.
	Molpastes bengalensis.
	Oriolus kundoo.
	Pastor roseus.
	Eudynamis honorata.
	Stauropala sordida.

Of cultivated berries the only record we have is that in some Madras hill districts (Shevaroys) some considerable damage is done at times, though not habitually, to coffee plantations by Bulbuls and Barbets, which migrate to the plantations to eat the coffee berries when their food supply has failed in their regular haunts. Practically all species of frugivorous birds take wild berries of various kinds, and should these occur in any locality in which there are cultivated berries of any kind, local damage may occur. We must not, however, assume from their wild feeding habits, that these birds will take the berries, but they must be proved definitely to

take the cultivated berries before any steps should be taken against them.

With regard to the vegetable diet of birds other than fruit it has already been mentioned that we can attach little, if any, importance in India to weed-seed or weed eating birds ; we attach no more importance to them than we do to weed eating insects. As a rule a weed-seed eating bird is spoken of as beneficial, while we seldom hear it said or see it stated that an insect with identically the same food material is beneficial. It is needless to say that both the birds and the insects have the same economic importance.

Weed-seeds are eaten by most of the *Passeres*, notably *Fringillidæ* (Finches), *Sturnidæ* (Mynahs and Starlings), *Motacillidæ* (Pipits), and to a less extent by *Corvidæ* (Crows and Magpies), *Merulinæ* (Thrushes), etc. Amongst other orders the *Columbidæ* (Pigeons and Doves) are the greatest consumers of weed-seeds, next to them being the *Phasianidæ* and *Pterocletidæ*, the latter of no economic importance agriculturally though said at times to take pulses. It must also be noted that in many instances in which the food has been recorded as grain it in reality consists of weeds. Self-sown corn or other self-sown cultivated seed is as much a weed as such plants which grow wild and are not under cultivation. This, I believe, applies at present to India as much as to other countries, in spite of the fact that we have in India a much more mixed cultivation than is generally the case elsewhere.

Cereals and other Crops.

The following is a list of cereals and other crops the seeds or plants of which are eaten or damaged by birds :—

Grain of various kinds is taken by practically all species of seed eating birds. Crows (*C. splendens* and *C. macrorhynchus*) at times do some considerable damage to various grain crops. The Starlings (*Pastor roseus, Acridotheres tristis* and *A. ginginnianus*) have a large proportion of the diet consisting of grain, whilst the Ploceidæ practically feed entirely on grain when available. Of other Passeres the Sparrows and Buntings at times do some damage to these crops.

The Parrots (*Psittaci*) are the most notorious grain pests, especially the Rose-ringed Paraquet. Of the Columbinæ *C. intermedia* and *C. eversmanni* are the only two species of importance, though most Pigeons other than Fruit Pigeons and all Doves take grain to some extent, the Doves chiefly by gleaning in the fields after the crops are off the land. All the Phasianidæ notably the Peacock, the Chukor, Jungle-fowl and the Common Grey-Quail, take grain to some extent as also some of the Cranes and Bustards. Several Ducks also feed to some extent on this kind of food.

Oats (*Avena sativa*).

There are practically no references to birds eating oats. They form a very considerable item in the diet of the two common crows—*Corvus splendens* and *C. macrorhynchus*—and have also been taken from the stomachs of *Acridotheres tristis*, *Gymnorhis flavicollis*, *Motacilla alba*, *M. personata*, and *Turtur suratensis*. The Black Partridge (*F. vulgaris*) gleans oats to a very marked extent. The crows take the ripe grain, newly planted seeds, and the young plants.

Barley (*Hordeum vulgare*).

Barley has been taken from the stomachs of *Corvus splendens* and *Turtur suratensis*, and is also said to be taken by Wood Pigeons, *Caccabis chucor* and *Nyroca marila*. Barley is not a general grain food for birds. The Demoiselle Crane is said to take barley seeds, newly sown.

Paddy (*Oryza sativa*).

Paddy is far the most commonly eaten of all the Indian grain crops, and at times a vast amount of damage is done to this crop not only by the grain being eaten but also to the young plants. In some localities crows are responsible for some damage, but by far more is done by various species of Weaver birds (*Ploceidæ*) and Munias (*Viduinæ*) some of the latter being known by the name of rice sparrows. *Turtur risorius* does some damage, feeding entirely on this grain when nearly or quite ripe. A few of the *Phasianidæ* take paddy mostly

by gleaning, whilst the Moorhen (*Porphyrio poliocephalus*) does immense damage to this crop. Of the cranes *Grus communis* and *G. antigone* do vast damage to paddy when young, in some cases attacking the seed beds. Many other birds are said to feed on paddy to some extent, but perhaps more damage is done by Geese and one or two species of ducks (*Dendrocycna spp.*, *Anas pœcilorhyncha*, *Querquedula circia*) than by all other species of birds together. They eat the grain as it becomes ripe. Wild rice forms the staple-food of some ducks.

MILLET (*Panicum miliaceum*).

This and other millets are taken by various birds chiefly the Quails, probably when available forming the main food of the Common Grey-Quail. Millets have been taken from the stomachs of *Corvus splendens*, *Anthus maculatus*, *Calandrella dukhunensis*, *Turtur risorius* and *Francolinus vulgaris*, but in no case in large numbers and none of these birds appear to feed habitually on this seed.

JUAR (*Sorghum vulgare*).

This crop does not appear to be eaten by a great variety of birds. The Mynahs,—*Acridotheres tristis* and *A. ginginianus*—have been noted as attacking this crop, and *Corvus splendens* to a minor extent. *Emberiza melanocephala* is also reported to attack juar. This crop is the favourite grain of the Rosy Pastor and an enormous amount of damage is done by this bird, especially in the Punjab.

Juar is particularly liable to the attacks of birds of all sorts after it begins to ripen.—Betoul, D. G., 1907.

WHEAT (*Triticum vulgare*).

Wheat has been taken from the stomachs of *Corvus splendens*, *Calandrella dukhunensis*, *Palœornis torquatus*, *P. cyanocephalus*, *Turtur suratensis*, and *T. risorius*, and is also eaten by the Peacock, the Chukor and the Common Grey-Quail. Of these birds, however, *P. torquatus* is the only real general pest to this crop, whilst the Peacock and the Chukor do

but local damage. The Quail probably obtains nearly all its grain food by gleaning. Crows do some considerable damage to the young plants, but nothing in comparison with that done by some of the Cranes, Geese and Ducks which often destroy acres of the young plants in a night. The Demoiselle Crane is said to be partial to wheat grain, and attacks newly sown grain.

MAIZE (*Zea mays*).

The common species of Crows take some considerable amount of maize, and all the common species of Mynahs especially *Acridotheres tristis* and *Sturnopastor contra*. Maize has been taken from the stomachs of these and also *Gymnorhis flavicollis* and *Palæornis torquatus* which is as great a pest on this crop as on all other grain crops. *Suthora ruficeps* and *Pavo cristatus* (Peacock) are also said to take this grain. The young plants do not appear to be damaged by birds, though the grain is in most cases taken before it is ripe.

LEGUMINOUS CROPS.

GROUND-NUT (*Arachis hypogœa*).

Occasionally taken by *Acridotheres tristis*, the common Mynah. In some localities this crop is much damaged by the Indian House Crow (*C. splendens*), and *Corvus macrorhynchus*.

RAHAR (*Cajanus indicus*).

Seeds have been taken from the stomachs of *Turtur suratensis*, *T. risorius*, and *Francolinus vulgaris*, but in small quantities only. The Common Quail (*Coturnix communis*) is said to glean the seeds from stubbles, and some of the Cranes especially *Grus communis* feed on the flower and pods alike. Some of the Bustards are partial to mustard flowers and therefore are almost certain to take the flowers on this crop, if not too high.

* CHENNA (*Cicer arietinum*). The Chick-pea.

Not a common food. It is said to be taken by the Peacock, two species of Quails (*C. communis*, and *C. coromandelica*),

* The author's meaning is not clear, *Cicer arietinum*, the chick-pea, is commonly called "Gram," whereas *Phaseolus mungo* is "Mung" or "Urid." [H. M. L.]

by the Demoiselle Crane and the Barred-headed Goose (*Anser indicus*).

LENTILS (*Lens escutenta.*)

Coturnix coromandelica feeds occasionally on this crop, and also Geese (*Anser indicus*).

"MOTH" (*Phaseolus aconitifolia*).

The only grain said to be touched by any of the Sand-grouse, and is rarely eaten by one species of this family—*Pterocles fasciatus*. Some, however, are said to eat beans (probably referring to this bean), and some to eat pulse—*P. alchatus*.

* GRAM (*Phaseolus mungo*).

The Peacock, Common Quails, Common and Demoiselle Cranes, one or two geese (*Anser ferus* and *A. indicus*) and *Casarca rutila* all feed to a minor extent on Gram. The quail, as usual, being said to take this food by gleaning.

PEAS (*Pisum sativum*).

All species of birds that take pulse of any kind will be found to take peas. They have been taken from the stomachs of *Corvus splendens*, *Palæornis torquatus*, and *Turtur risorius*, and most Wood-pigeons, Quails, Partridges and Cranes also take them to some extent. Two species of Bulbuls are said to take peas, namely, *Molpastes hæmorrhous*, and *Otocompsa emeria*, and to do some damage to garden produce in this way.

VETCHES (*Vicia sativa ?*)

Said to be taken by *Chibia hottentotta*, *Carpodacus erythrinus*, *Copsychus saularis*, and *Coturnix communis*, but with the exception of the latter species probably only when the usual food-supply has failed, or by mistake with other food.

OTHER CROPS.

POTATOES (*Solanum tuberosum*).

Rooks and Moorhens (*Porphyrio*).

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* The author's meaning is not clear, *Cicer arietinum*, the chick-pea, is commonly called "Gram," whereas *Phaseolus mungo* is "Mung" or "Urid." [H. M. L.]

CHILLIES (*Capsicum frutescens*).

Corvus splendens, but only when these are put out to dry, after the harvest. No bird appears to touch them in the field.

The Nepal Chilli (*C. fastigatum*) is said to be taken occasionally by *Macropigia rufipennis*, the Andaman Cuckoo-dove.

TIL (*Sesamum indicum*).

Sypheotis aurita the Likh, is said to take the buds.

SWEET POTATOES. (*Ipomœa batatas*).

(Taken by the Common Crane in China).

LINSEED (*Linum usitatissimum*).

These seeds have been taken, though seldom so, from the stomachs of *Corvus splendens*, *Turtur risorius*, and *T. suratensis*.

SAFFLOWER (*Carthamus tinctorius*).

Apparently at times forms some considerable proportion of the food of the Common Crane.

BUCKWHEAT (*Fagopyrum esculentum*).

Suthora ruficeps, a crow-tit, is said to take this grain.

TURNIPS (*Brassica rapa*).

Wood-pigeons and Bustards are both recorded as taking turnips. In India the pigeons are the only birds likely to do any damage to this crop as it is essentially a garden crop in this country.

MUSTARDS (*Brassica spp.*)

Mustard has been taken from the stomachs of several species of birds, all of which do some considerable damage to this crop. The two Doves *Turtur risorius* and *T. suratensis* take the seeds from the plants as well as by gleaning, but *Palœornis torquatus* is a serious pest to the mustard crops. Other birds such as the Partridges and Bustards eat a considerable amount of the leaves and shoots of the mustard plants, and *Rostratula capensis*, the Painted Snipe, is said to eat the seeds. Sarson (*B. campestris*) is taken by *Otis tetrax*.

VEGETABLES.

The two Cranes *Grus communis* and *Anthropoides virgo* are both said to take various vegetables and possibly do some damage.

WATERMELONS. *Grus communis* (Common Crane).

NUTMEGS (*Myristica fragrans*).

The Pied Imperial Pigeon is the only species of bird that is recorded as eating these nuts, a fact which its generic name, *Myristicivora*, seems to imply.

PALM NUTS (*Areca catechu*).

These nuts are eaten by some of the Fruit Pigeons and Parrots.

WALNUTS (*Nuciphraga hemispila*).

Nuts are taken generally by Magpies, Jays, and (Sittidæ) Nuthatches.

ANIMAL DIET OF BIRDS.

Mammals.—Rats and mice of various species are the two forms of this kind of food most usually eaten. Rats are injurious, but mice we cannot include as such as many species are of no agricultural importance, and shrews are often not discriminated from mice in referring to bird's food and this latter group is beneficial.

Mice are eaten occasionally by one or two Kingfishers, by nearly every species of Owl and Hawk, and occasionally by Moorhens and Cranes.

Rats are taken by very much the same class of birds, but not apparently by the two latter groups.

Small mammals, probably referring to rats and mice, are said to be eaten by Shrikes, Ground Cuckoos, Horn-bills, Owls and Hawks of various species, and occasionally by Cranes and Bustards.

Hares, which are of little if any economic importance, are taken by a few of the larger species of Owls and Hawks. Squirrels, which are injurious, are taken occasionally by *Lanius lahtora*, by Owls (*Syrnium ocellatum* and *Nyctea scandiaca*) and one or two species of Eagles (*Aquila vindiana*, *A. maculata*, *Hieraëtus pennatus*, and *Spizaëtus cirrhatus*). The common striped squirrel (*Sciurus palma-*

rum) is here regarded as injurious as it is said to carry the plague flea. It feeds largely on insects, and may often be seen carrying large crickets such as *Brachytrypes achatinus*, and *Gryllotalpa africana*.

Voles and other small rodents are taken by Owls, and Shrews by *Strix flammea*, *Bubo ignavus*, *Athene brama*, *Haliastur indus*, *Circus macrurus* and *Buteo desertorum*.

Moles by *Asio otus*.

Of the larger Mammals—Wolves, Foxes and Antelopes are taken by *Aquila chrysaëtus*, the latter being also taken by *Falco cherrug*, Gazelles by *Astus palumbarius;* bears (young), ibex, chamois, children, goats, markhor and *Ovis ammon* are taken by *Gypaëtus barbatus;* Fawns of deer by *Bubo ignavus*, *Huhua nepalensis* and *Aquila chrysaëtus;* Ewes and lambs by the larger *Corvidæ*, *Aquila chrysaëtus* and *Haliastur albicilia*.

Leptoptilus dubius is said to have taken a cat; bats are occasionally taken by *Dendrocitta rufa*, *Ictinaëtus malayensis*, *Aesalon chiquera* and *Falco peregrinator*.

Birds.—Most predaceous birds, especially Owls and Hawks take a variety of birds as a portion of their food; as a rule the larger species also take game birds of all kinds and some of them make inroads on poultry and pigeons, etc.

Attacks on poultry runs and domesticated pigeons are practically confined to various members of the Falconidæ. Of this group the Eagles almost without exception take chickens, pigeons and sometimes ducks. Of Kites both the common species *Haliastur indus* and *Milvus govinda* are at times great nuisances near chicken runs, and especially during their breeding seasons, they appear to take pigeons, but seldom game and rarely ducks. *Falco* spp. *Astur palumbarius*, *Lophospiza trivirgatus*, and *Spilornis cheela* all do some damage, the latter having once been recorded as having taken a Turkey. Owls but rarely take poultry; *Acridotheres tristis* is said to take chickens' eggs.

Pheasants are said to be taken by *Huhua nepalensis*, *Spizaëtus nepalensis*, *Astur palumbarius*, *Falco peregrinus* and *Ictinaëtus malayensis*.

Partridges are said to be taken by *Aquila vindhiana*, *Astur palumbarius*, *Hieraëtus fasciatus*, *Ictinaëtus malayensis*, *Spizaëtus cirrhatus*, *S. nepalensis*, *Falco peregrinus*, *F. barbarus*.

Pea-fowl by *Bubo bengalensis*, *Haliaëtus fasciatus*, *Spizaëtus cirrhatus*.

Quail by *Butastur teesa*, *Circus macrurus*, *Ictinaëtus malayensis*, *Spizaëtus cirrhatus*, and *Falco peregrinus*; *C. communis* by *Glaucidium cuculoides*, *C. coromandelicus* eggs by *Centropus sinensis*, and *Eupodotis edwardsi* is also said to take Quail's eggs.

Jungle-fowl by *Ictinaëtus malayensis*, *Spizaëtus cirrhatus*, and by *Hieraëtus fasciatus* which bird also takes Spur-fowl.

(Moor-fowl are taken by *Aquila chrysaëtus*, and *Falco peregrinus*).

Floricans (*Sypheotis aurita*, etc.) are taken by *Aquila vindhiana* and by *A. heliaca*.

Ducks and geese are taken by *Falco peregrinus* and by nearly every species of Eagles (*Aquila chrysaëtus*, *Circaëtus gallicus*, *Hieraëtus fasciatus*, *Haliëtus leucoryphus*, *Polioaëtus ichthyaëtus*) and also by *Circus æruginosus*.

Small birds may form part of any predaceous bird's food, but they do so of Hawks and Owls especially. Other than these, Crows, Magpies, Shrikes, King-fishers, Adjutants, and Skuas all take them to some extent. Nestlings are said to have been taken by Starlings.

Eggs are largely eaten by various members of the Corvidæ.—Hooded, common, and carrion Crows, Ravens, Magpies and Jays—also by *Larinæ* (Gulls), *Stercorariidæ* (Skuas), *Limicolæ*, *Rallidæ*, *Pelargopsis gurial*, *Bucerotidæ* (Hornbills), *Centropus sinensis*, and *Circus* spp.

Small birds have been taken from the stomachs of *Dendrocitta rufa*, *Butastur teesa*, *Milvus govinda*, *Haliastur indus*, *Astur badius*, and *Pernis cristatus*.

Fish.—It is a noticeable fact that though fish form a large proportion and in some cases the whole of the diet of many birds, yet among the Passeres, which contain more than half the known

species of birds in India, we find no single species feeding on live fish and only a few members of the family—the Crows—eating dead fish—that is carrion.

Amongst other families the Terns (*Sterninæ*), Skuas (*Stercorariдæ*), Frigate-birds (*Fregatidæ*), Gannets (*Sulidæ*), Tropic-birds (*Phaëthontidæ*), Pelicans (*Pelecanidæ*), Cormorants (*Phalacrocoracinæ*) and the Mergansers (*Merginæ*) feed almost entirely on fish, the last three groups occurring inland on rivers and lakes, &c. The King-fishers (*Alcedinidæ*), and the *Herodiones* which include Ibises, Spoon-bills, Storks, and Herons, feed largely and, in some cases, almost entirely on fish.

Many species of Owls and Hawks feed habitually on fish, and with the Fish-owls (*Ketupa*), the Ospreys (*Pandionidæ*) and the Fish-Eagles (*Haliaëtus*) this is practically the only class of food taken. Ducks (*Anatidæ*), Cranes (*Gruidæ*) and the Waders (*Limicolæ*) all feed on fish to a small extent, while the Gulls practically eat nothing but dead fish.

Fish have been taken from the stomachs of the Pied King-fisher (*Ceryle varia*), the Pond Heron (*Ardeola grayi*), and the Black Ibis (*Inocotis papillosus*).

Eel: recorded as taken by *Spilornis cheela*, and *Ardea cinerea*.

Flying-fish taken by Frigate-birds (*Fregatidæ*), *Sula leucogaster* —the Brown Gannet and *Phaethon flavirostris*, the White Tropic-bird.

Fish-Spawn.—This form of food is apparently taken only by one or two species of ducks, *Sarcidiornis melanonotus*, *Netta rufina*, *Nyroca fuligula* and possibly by the Dipper (*Cinclus asiatica*).

Frogs.—No bird takes frogs entirely as the only article of food. Frogs are eaten to some extent by Crows (*Corvidæ*), Starlings (*Sturnidæ*), King-fishers (*Alcedinidæ*), and Ground Cuckoos (*Centropus*), but by none of these groups so much as by various species of Owls and Hawks or by the Storks, Herons, &c. (*Herodiones*), and by Ducks especially the *Merginæ*. Shrikes (*Laniidæ*), Bustards (*Otididæ*), and Cranes (*Gruidæ*) are also said to eat frogs.

Frogs have been taken from the stomachs of the following :— Indian House Crow (*Corvus splendens*), Jungle Crow (*C. macrorhynchus*), Jungle Babbler (*Crateropus canorus*), Coucal (*Centropus sinensis*) White-eyed Buzzard Eagle (*Butastur teesa*), Brahminy Kite (*Haliastur indus*), Common Pariah Kite (*Milvus govinda*), the Common Heron (*Ardea cinerea*), and during the rains form a large percentage of the food of the Black Ibis (*Inocotis papillosus*).

Amphibians generally are said to be taken by Cranes, and Grebes.

Reptiles.—Reptiles (snakes and lizards) are taken to some extent by Owls, Hawks, Cranes, and Storks and to a less extent by some King-fishers, Bustards, Shrikes, Hornbills, Ground Cuckoos, Grebes and Magpies, and also by *Anas boscas* and the Peacock (*Pavo cristatus*).

Russell's Viper is recorded as having been taken by *Leptoptilus dubius*.

Tortoises and Turtles by *Gypaëtus virgatus*, *Haliaëtus*, *Leucorhyphus* and *Fregatidæ*.

Lizards, though taken by many birds, do not form the main diet of any one species. They are taken by Crows, Magpies, Shrikes, King-fishers, Ground Cuckoos (*Centropus*), by various species of Owls and Hawks (*Falconidæ*) and occasionally by the Peacock; by Cranes, Ibises, Storks and even some species of Ducks.

In all probability all species of birds that take lizards take frogs as well. Lizards have been taken from the stomachs of the Coucal (*Centropus sinensis*), White-eyed Buzzard Eagle (*Butastur teesa*), *Haliastur indus*, *Milvus govinda*, *Pernis cristatus* and *Dendrocitta rufa*. The latter and also Crows have frequently been seen feeding on these animals.

The following are recorded :—Monitor by *Circaëtus gallicus*, *Calotes versicolor* by *Halcyon smyrnensis*, and Chameleons by *Baza*.

I have not observed the food of most of the common lizards, but the common House Lizard (*Hemidactylus gleadovii*), eaten to some extent by the Tree-pie (*Dendrocitta rufa*) is certainly beneficial,

and it will in all probability be found that other species are equally beneficial.

Spiders.—Are taken frequently by many birds, though in most cases not forming any great proportion of the food taken by any one species. Some of the *Nectarinidæ*, however, are said to consume large quantities, a few living mainly on them. Spiders have been taken from the stomachs of the Tree-pie (*Dendrocitta rufa*), Jungle Babbler (*Crateropus canorus*), Common Iora (*Aegithina tiphia*), King-Crow (*Dicrurus ater*), Crowned Willow-warbler (*Phylloscopus superciliosus*), Bush Chat (*Tephrodornis pondicerianus*), Indian Oriole (*Oriolus kundoo*), Black-headed Oriole (*Oriolus melanocephalus*), Magpie Robin (*Copsychus saularis*), Grey-headed Wagtail (*Motacilla borealis*), Indian Pipit (*Anthus rufulus*), Purple Sun-bird (*Arachnechthra asiatica*), Blue Jay (*Coracias indica*), Common Bee-eater (*Merops viridis*), Hoopoe (*Upupa indica*), Coucal (*Centropus sinensis*), and the Black Partridge (*Francolinus vulgaris*). None of these contained spiders in numbers sufficient to be of real economic importance.

Other Araneida recorded are :—*Trombiduim tinctorum.*—Taken by *Coturnix coromandelica* and *Scorpions* taken by *Centropus sinensis*, *Inocotis papillosus*, and *Plegadis falcinellus.*

Earth-Worms.—Many birds, and especially those that like water or moist localities, feed to some extent on worms. Crows, Babblers, King-crows, Wrens, Shrikes, Starlings, Thrushes, Larks and Wagtails and Robins all feed on worms to a greater or less extent. Hoopoes, a few Owls and Hawks, Game birds, Cranes, and all the water birds and Ducks take their share. Worms have been taken from the stomachs of the House Crow (*Corvus splendens*), the Jungle Crow (*C. macrorhynchus*), Jungle Babbler (*Crateropus canorus*), King-crow (*Dicrurus ater*), Common Mynah (*Acridotheres tristis*), and Magpie Robin (*Copsychus saularis*) Black Ibis (*Inocotis papillosus*), (*Alauda gulgula*) the Indian Skylark and the Hoopoe (*Upupa indica*) have been noticed eating them. Crows, Mynahs, Magpie Robins and other common species may often be seen feeding on worms in the rains, and in the

hot weather they obtain them from the sides of water channels used for irrigation.* Earthworms are generally regarded as beneficial owing to the physical effect they have on the soil.

Annelids.—Recorded as taken by *Motacilla madraspatensis* (in captivity), and by *Limosa lapponica.*

Crustacea.—These animals form some considerable proportion of the food of many water haunting species of birds, those that take them most frequently being the King-fishers (*Alcedinidæ*), Rails (*Rallidæ*) *Heliornithidæ*, Cormorants (*Phalacrocoracinæ*), Petrels (*Turbinares*), the Herodiones—*Ibididæ*, *Plataleidæ*, etc.—Storks (*Limicolæ*), Waders, Gulls (*Gaviæ*) and Terns, Skuas (*Stercorariidæ*), Ducks *Anseres*), and Grebes (*Podicipididæ*).

Red Crabs by *Netta rufina.*

Crabs by *Corvus splendens*, Shrikes, King-fishers, Ground Cuckoos, Owls especially the genus *Ketupa*, Hawks and Eagles, Frigate-birds (*Fregatidæ*), Storks and Egrets, and by Gannets.

Prawns by *Pelargopsis gurial*, *Haliastur indus*, *Hydroprogne caspia*, *Inocotis papillosus*, *Ardeola grayi*, *Tadorna cornuta*, and *Podicipes nigricollis.*

Shrimps by *Halcyon smyrnensis*, *Rallina canningi*, *Limosa belgica*, *L. lapponica*, *Gallinago coelestis*, *Tadorna cornuta*, *Casarca rutila*, *Mareca penelope*, *Querquedula circia*, *Nyroca ferruginea.*

Artemia salina by *Phœnicopterus roseus.*

Cray-fish by *Merganser castor.*

Wood-lice by *Micropus melanocephalus*, and *Coridagrus concretus.*

Mollusca.—These animals include snails, slugs and shell-fish generally. They are taken for food by birds that for the most part frequent damp localities, in many cases forming the principal food of such birds. Many birds, however, take pieces of shell for the same reason that other species take small stones and grit,

* The king crow almost invariably robs the worms he eats from other birds.

namely, for trituration to aid in the digestion of other food materials, and not as direct articles of food.

Crows, Magpies, some of the Phasianidæ, Thrushes (*Merulinæ*), and Dippers (*Cinclinæ*) all take Mollusca to a certain extent and especially the two last groups. But it is among the Limicolæ, Herodiones, and Anseres that we find the species of birds that eat this class of food to any great extent. The following shells have been taken from the stomachs of various birds:—

Vivipara crassa from *Anas poecilorhyncha.*

Planorbis sp. from *Querquedula circia, Gallinago cœlestis, Tringa minuta, Totanus ochropus, T. glareola, Hoplopterus ventralis, Anthus maculatus,* and *Calandrella dukhunensis.*

Melania tuberculata from *Querquedula circia, Totanus ochropus, T. glareola, Hoplopterus ventralis, Amaurornis phœnicurus.*

Corbicula orientalis from *Totanus calidris, T. ochropus, T. glareola, Hydrophasianus chirurgus, Centropus sinensis,* and *Calandrella dukhunensis.*

Bythinia sp. from *Sarcogrammus indicus* and *Upupa indica.*

Unio favidens from *Amaurornis phœnicurus.*

Hydrobia sp. from *Motacilla alba.*

Vivipara sp.? or *Ampullaria* sp.? The opercula of some species of shell of one of these two groups were found in *Querquedula circia, Hydrophasianus chirurgus,* and *Centropus sinensis.*

Shells of other species and genera were taken from *Querquedula circia, Gallinago cœlestis, Rostratula capensis, Tringa minuta, Totanus glareola, Hydrophasianus chirurgus,* and *Calandrella dukhunensis.*

The following are also recorded in various references:—

Ampullaria sp. and *Unio* sp. from *Anastomus oscitans.*

Bulimi from *Sturnia blythii,* and *Alsocomus elephinstoni.*

Helix bistralis from *Merula nigripileus.*

Uromastrix from *Falco cherrug.*

(Limpets from *Hæmatopus ostralegus* and Mussels from *Nyroca marila.*)

Of Cephalopods the following:—

Squids are said to be taken by Gannets (*Sulidæ*) and Tropic birds (*Phæthontidæ*);

Cuttle-fish by Frigate birds (*Fregatidæ*), and Gannets (*Sulidæ*);

Cephalopods generally by *Sterna fuliginosa*, and by the *Procelliformes.*

Coelenterata.—Acephala or Jelly-fish are said to be taken by *Limosa lapponica* and the *Procelliformes.*

Annelida.—Leeches (*Hirudinia*) are said to be taken by *Bubulcus coromandus* from crocodiles.

Myriopods.—Centipedes are possibly beneficial, but do not form any considerable proportion of the food of any bird, in fact, they are seldom eaten at all. They are recorded as eaten by *Petrophila salitoria, Brachypternus aurantius, Bichoceros bicornis, Glaucidium radiatum, Circaëtus gallicus, Eupodotis edwardsi, Sypheotis aurita*, and *S. bengalensis.*

I have taken them from the stomachs of the following:—*Corvus macrorhynchus, C. splenadens, Dendrocitta rufa, Crateropus canorus, Centropus sinensis.* The Bustards (*Oudidæ*) are also said to eat Myriopods.

Insects.—The main work in economic entomology lies naturally in accumulating facts about the food of birds both by observations in the field and by the examination of the stomach contents in the laboratory. This is the basis on which everything depends—our facts. It can, however, be understood readily that these accumulated facts are of no immediate practical value until we have settled finally up to the present time the economic importance of the food taken, speaking more especially from a Zoological point of view.

The classification of insects into definite groups with regard to their economic importance can at present be but a temporary one, and will undoubtedly need modifications from time to time: until we know more of the food of animal life in general the real economic importance of many species of birds can but remain an unknown quantity.

The present classification of insects adopted here with regard to their economic importance has been arranged in consultation with H. M. Lefroy, Esq., Imperial Entomologist, and contains therefore as near as possible the correct economic importance of the insects mentioned, considering how limited is the knowledge of even some of the commonest insects in India at the present time.

It must be borne in mind that the economic importance of the insect food as stated in this paper is strictly with reference to what is known of the food plants, or otherwise of the insects at present recorded as taken by birds in India. Families of insects (*e.g.*, Elateridæ) well known as pests in other countries are not included as pests in this paper unless we know that they are pests in India, or that from the food of other insects of the same family or genus as the insect in question these latter are undoubted pests, there being every reason therefore for assuming that this insect is also injurious, though its habits and life-history are yet unknown, or imperfectly known. Beneficial and neutral insects are treated in a similar manner.

ORTHOPTERA.—*Forficulidæ.*

The Earwigs are in some few instances said to be injurious to flowers, etc., but are not reported so from India. Little apparently is known about their food in any country, and they have therefore been included as neutral. Vegetable and animal matter are possibly taken alike for food.

Forficulidæ are taken as food by birds to a small extent only. *Chelisoches melanocephalus* was found to be taken by the Hoopoe (*Upupa indica*); 5 specimens of *Labidura riparia* were found in

a water-hen (*Amaurornis phœnicurus*). Other, or the same species also occurred in *Calandrella dukhunensis*, *Coracias indica*, *Sarcogrammus indicus*, and *Inocotis papillosus;* a number of specimens also in a *Caprimulgus macrurus*.

Blattidæ.

The Cockroaches are classed as neutral. It is a well known fact that damage is done by these insects to stored goods, but it is obvious that, unless migrating across the open, birds cannot get at these insects in order to feed on them. (Turkeys do so, and probably other poultry). The food of species other than those that occur in stores consists of dead animal and vegetable matter, the insects being in reality scavengers.

Cockroaches are probably taken by most ground feeding birds which eat insects, but have only been noticed in the stomachs of *Crateropus canorus* and *Phylloscopus superciliosus*.

Acridiidæ.

All the locusts and grasshoppers are injurious. Some are major and regular pests to crops, whilst others, though not habitually found on cropped areas, may possibly make inroads on crops especially when young. They are eaten by practically every species of insectivorous bird, and form one of the main supplies from which birds in India draw their insect food. They include the swarming locusts and all kinds of grasshoppers, of which *Chrotogonus* spp., the well-known ground grasshoppers, which every year do great damage to young crops as they are coming above ground, are worth special mention.

The Starlings and Mynahs are perhaps the greatest enemies of these insects, and special mention must be made of the locust-eating propensities of the Rosy Pastor (*Pastor roseus*), No. 528. Crows, the smaller Owls, and Hawks also at times feed on these insects to a very large extent.

The following genera are noted as taken by birds :—*Acridium*, *Atractomorpha*, *Cyrtacanthacris*, *Gastromargus*, *Chrotogonus*, *Oxya* and *Tryxalis*.

Phasmidæ.

Stick insects are included as neutral for India, though well known as defoliators elsewhere. They are said to be taken by the *Podargidæ* or Frogmouths.

Mantidæ.

Praying insects are generally regarded as beneficial and are here so also. They are general insect feeders, preferring the softer varieties, such as moths and flies, and possibly caterpillars to some extent.

Many birds will certainly be found to take these insects, in fact, we may expect all such birds as take locusts and grasshoppers to take praying insects. There are numerous references to birds taking them, but we have only one definite record, namely, that an egg mass was found in a Water-hen (*Amaurornis phœnicurus*).

Green grasshoppers are both predaceous and herbivorous and little is known about their food. They have been included as neutral as a class.

Schizodactylus monstrosus, the only species of this group definitely identified as forming part of bird's food, is freely taken by *Coracias indica*, *Upupa indica*, *Hierococcyx varius*, also by the Commoner Hawks, Kites, Ibises, etc. This species is injurious.

Gryllidæ.

Crickets are included among the injurious insects. Of the smaller species little seems to be known. The larger species mentioned below are burrowers feeding on vegetation and sometimes committing some damage by cutting off young plants close by the roots. The following species have occurred in birds examined:—*Liogryllus bimaculatus*, *Gryllotalpa africana*, *Gryllodes melanocephalus*, and *Brachytrypes achatinus*, these being taken chiefly by Crows, Shrikes, Blue Jay (*Coracias indica*), the Hoopoe (*Upupa indica*), the King-crow (*Dicrurus ater*), Cuckoos, the Owlet (*Athene brama*), Hawks of various kinds and other birds to a less extent. They are in fact taken by much the same species of birds as the *Locustidæ*, the King-fisher (*Halcyon smyrnensis*) being also partial to *Brachytrypes achatinus*.

NEUROPTERA.

Odonata.—The Dragon-flies, though so abundant a form of insect life, are comparatively rarely taken as food when in the imago state by birds. The larval forms are most frequently taken and possibly form a large percentage of the insect-food of the *Ardeæ* and other water frequenting birds which take aquatic insects. Most references that we have to birds taking aquatic insects probably refer to the larvæ of *Odonata*. We know little of the food of the imagines (they undoubtedly take Ephemerids and at times butterflies) and the larvæ are, as far as we know, carnivorous. These insects have therefore been included as beneficial—they are usually regarded as such.

The *Meropidæ* take these insects only on dull days. *Crocothemis servillia* has been noted as taken by *M. viridis*, *M. philippinus*, and *Ardeola grayi*; *Platygomphus dolobratus* by *M. viridis* and *Ardeola grayi*; *Rhyothemis variegata* by *Sypheotis bengalensis*; and *Trithemis pallidinervis* by *Lanius erythronotus*, *M. philippinus* and *Ardeola grayi*. Zygopterids by *Totanus glarola* and *Ardeola grayi*. Dragon-flies are also occasionally taken by *Dicrurus ater*, *Siphia albicilia*, and *Sterna seena*, and are said to be taken by *Dissemurus paradiseus*, *M. persicus*, *Falco subbuteo*, and *Nyroca ferina*.

Phryganeidæ.—Caddis-flies are both vegetable feeders and carnivorous and are included as neutral. They are said to be eaten by *Nyroca ferruginea*.

Ephemeridæ.—May-flies; probably of similar feeding habits to the *Phryganeidæ*, but little appears to be known about either group. They are therefore also included as neutral. They are taken as food to some extent by birds, such as *Dicrurus ater*, *Cisticola cursitans*, *Phylloscopus tristis*, *Tephrodornis pondicerianus*, *Sturnus malabarica*, *Acridotheres tristis*, *Anihus maculatus*, and *Brachypternus aurantius*.

Termitidæ.—The White-ants are well-known pests to timber, wood fabrics, etc., and are injurious. They form a considerable

proportion of the food of a number of birds when the winged forms emerge from the nests at the beginning of the rains. They have at such times been noticed to be taken by the following birds : *Corvus macrorhynhusc, C. splendens, Dendrocitta rufa, Crateropus canorus, Molpastes bengalensis, Sitta caitaneiventris, Dicrurus ater, Oriolus kundoo, O. melanocephalus, Acridotheres tristis, Anthus rufulus, Thereiceryx zeylonicus, Coracias indica, Upupa indica, Butastur teesa, Haliastur indus, Turtur suratensis,* and *T. risorius.* At the same time *Dendrocitta rufa* and possibly some other species take the unwinged forms of Termites which may then be found at the emergence holes of the Termites. Other birds such as various species of Bulbuls, Drongos, Shrikes, Flycatchers, Sunbirds, Rollers, Swifts, Owls and Hawks are also recorded as taking these insects, and in *Journal B. N. H. S.* (Vol. IX, 229), the following occurs : "I know of no fruit or grain-eating bird that will not readily eat these insects." Possibly the greatest check that we have on these insects in the field is the *Phasianidæ*, most of which birds seem to be particularly fond of the White-ants and feed on them habitually, scraping and scratching in the nests of the insects and by no means taking them at the time of emergence only.

Hemerobiidæ.

Myrmeleo sp.—Ant-lions are beneficial. They have occurred occasionally in the stomachs of *Oreocincla dauna, Upupa indica,* and *Francolinus vulgaris.*

HYMENOPTERA.

Chrysidæ or Ruby Wasps are parasitic on other Hymenoptera mostly on common species of *Eumenes* which are caterpillar feeders principally. This family has, therefore, been placed as injurious. As may be expected with such hard insects they seldom form the food of birds, having only been noticed to be taken by *Dendrocitta rufa, Dicrurus ater, Merops viridis, M. philippinus, Francolinus vulgaris, Motacilla alba,* and *M. personata* and even then in very few instances.

HYMENOPTERA ACULEATA.

Mutillids.—Little is known of this group, and it is therefore regarded as neutral. *Mutilla discreta* occurred in a *Francolinus vulgaris* and *Mutilla sex-maculata* in *Dendrocitta rufa.*

Scoliidæ.—The feeding habits of these insects are not known: they possibly parasitise the larvæ of Cockchafers: they must be regarded as neutral.

Scolia quadri-pustulata was found in *Dicrurus ater* and *Acridotheres tristis; Tiphia* sp. in *Copsychus saularis* and *Merops viridis.*

Pompilidæ.—Not enough is known at present to state for certain whether these insects are beneficial or otherwise. A number of species apparently feed on spiders, but they apparently have other animal food. Once only has a member of this group been found to be taken by a bird, namely, *Pompilus subsericeus* by *Francolinus vulgaris.*

Sphegidæ.—This group has varied habits preying on insects and spiders. As a group it is neutral. *Sphex lobatus*, a beneficial form which kills crickets, was found to be taken, though not commonly in any case, by *Dendrocitta rufa*, *Merops viridis*, *Cuculus micropterus*, and *Francolinus vulgaris*; and *Stizus vespiformis* by *Dicrurus ater.*

Eumenidæ.—These Wasps are predaceous on caterpillars and may certainly be regarded as beneficial. *Rhynchium* is the only genus we have found to be taken by birds. *R. bengalense* is taken freely by *Merops philippinus*, and we have an interesting record of *Thereiceryx zeylonicus* taking the same species. Other species have been taken from the stomachs of *Dendrocitta rufa*, *Oriolus melanocephalus*, *Coracias indica*, and *Merops philippinus.* These insects are, however, not a general insect food for birds.

Vespidæ.—The true wasps have been included as neutral. Many feed habitually on insects of various kinds, and act as a considerable check on the numbers of caterpillars, but again some

damage is done to fruits and some species are dangerous, because of their fierce nature. They do not form a large proportion of the food of many birds, the Meropidæ being perhaps the only family of birds that habitually feeds on them. *Vespa orientalis* was found to be taken by *Merops viridis*, *M. philippinus*, *Dendrocitta rufa*, and *Caprimulgus macrurus ; Polistes hebræus*, which we may consider a beneficial species, was taken by *Dendrocitta rufa*, *Oriolus melanocephalus*, *Acridotheres tristis*, *Merops viridis*, *M. philippinus*, and *Sypheotis bengalensis*, and is said to be taken by *Merops apiastur*.

Apidæ.—Bees of both the common species *Apis florea* and *A. indica* are beneficial for their flower visiting propensities alone, the former being especially noticeable on peaches when in flower, and undoubtedly most of the fertilization of these flowers is due entirely to these insects. *Apis indica* is also "a very important flower fertilizing insect." These two species are practically only taken by the *Meropidæ* or Bee-eaters, though the *Indicatoridæ* and *Pernis cristatus* are said to be very partial to the grubs and honey. They have also been taken from the stomachs of *Molpastes bengalensis*, *Copsychus saularis*, *Iyngipicus hardwickei*, and *Amaurornis phœnicurus*. The *Meropidæ* will probably prove a great nuisance to any Bee-keeping industry that may be started in the plains, these birds being persistent feeders on all kinds of Hymenopterous insects except ants and a few others. *Halictus cuniculus* was taken by *Merops viridis* and *Xylocopa dissimilis* by *Merops philippinus*, this latter species being beneficial as it plays a very important part in the fertilization of Sann Hemp and possibly other leguminous crops. *Megachile carbonaria* was taken by *Merops philippinus*.

Formicidæ.—Ants are of very doubtful economic importance. Some are at times troublesome household pests, others again keep *Aphides*, etc., feeding on the honey-dew secreted by these insects. Some are perhaps beneficial in that they are scavengers, and many of those that nest in the soil have some influence beneficially in breaking down that soil. We class them here as neutral.

The Ants, like the grasshoppers, are exceedingly abundant insects and form a very large proportion of the insect food of birds in India. They are perhaps the favourite food of the Woodpeckers, Wrynecks, Rollers, and some of the Pheasants. Most birds that eat insects of any kind will almost certainly be found to take ants of one species or another. The following species occur in this paper as taken by birds :—*Acantholepis frauenfeldi var. bipartita*, *Camponotus compressus*, *Cataulacus taprobanæ*, *Cremastogaster subnuda*, *Dorylus* sp., *Meranoplus bicolor*, *Myrmecocystes setipes*, *Œcophylla smaragdina*, *Phidole malinsi*, and *Polyrachis simplex*.

COLEOPTERA.—*Beetles.*

Scarabæidæ.—Dung Beetles. Amongst these insects are included the *Coprinæ*, *Aphodiinæ*, *Geotrupinæ* and *Troginæ*, species of all of which are mentioned. They may possibly play some important part in burying in the soil manure, which, without their aid, would be washed away by rain or otherwise lost. This appears, however, to be of somewhat doubtful importance, and the whole of this family are here regarded as neutral.

This family is an exceedingly numerous one in species and in individuals, and forms a considerable proportion of the insect food of birds.

Scarabæini.—Various species of *Gymnopleurus* occurred in *Coracias indica*, *Corvus splendens*, *C. macrorhynchus*, *Molpastes bengalensis*, *Ruticilla rufiventris*, *Merops viridis*, *M. philippinus*, *Francolinus vulgaris*, *Cotile sinensis*, *Sarcogrammus indicus*, *Caccobius vulcanus* in *Francolinus vulgaris*.

Coprini.—Of the Coprids *Catharsius sabæus* is taken by *C. macrorhynchus*, *C. splendens*, *Molpastes bengalensis*, *Coracias indica*, *Caprimulgus macrurus*, *Athene brama*, and *Butastur teesa*. *Copris orientalis* by *Centropus sinensis*. *Onitis distinctus* by *Sarcogrammus indicus* ; *Onitis philemon* by *Caprimulgus macrurus* which also with *Francolinus vulgaris* took *Onthophagus bonasus* ; other species of *Onthophagus* by *Corvus macrorhynchus*, *C. splendens*, *Crateropus*

canorus, *Molpastes bengalensis*, *Dicrurus ater*, *Sturnopastor contra*, *Ruticilla rufiventris*, *Gymnorhis flavicollis*, *Copsychus saularis*, *Coracias indica*, *Merops viridis*, *Upupa indica*, *Athene brama*, *Milvus govinda*, *Francolinus vulgaris*, *Totanus glareola*, *Amaurornis phœnicurus*, and *Sarcogrammus indicus*. *Onticellus pallipes* by *Corvus splendens*, and *Dicrurus ater*.

Aphodiinæ.—These being smaller insects than the preceding are, as may be expected, taken by smaller species of birds, such as *Orthotomus*, *Sipkia*, *Aegithina*, *Sitta*, *Phylloscopus*, *Anthus*, *Calandrella*, *Motacilla*, etc., and in some instances they form a fairly large percentage of the food of those small birds. *Francolinus* and *Upupa* are also recorded as taking them.

Geotrupinæ.—Only two occurrences were noted. *Bolboceras calanus* was seen to be partially eaten by a Mynah (*A. tristis*) and was also once found in *Francolinus vulgaris*.

Troginæ.—*Trox* (*indicus?*) is freely eaten by *Coracias indica* and *Hierococcyx varius*, and also occurred in *Francolinus vulgaris*, *Crateropus canorus*, *Sypheotis bengalensis* and *Œdionemus scolopax*.

Melolonthidæ.—The Chafers are regarded as injurious as they are chiefly plant root feeders; some species, too, at times do some considerable damage by destroying leaves and flowers of crops, garden plants, etc.

The larvæ of these beetles are eaten in considerable quantities by *Dicrurus ater*, Common Mynahs, *Upupa indica* and *Hierococcyx varius*; also sometimes by *Copsychus saularis*, *Coracias indica*, *Cuculus micropterus*, *Francolinus vulgaris* (and by *Gennæus melanotus*).

Apogonia carinata (Melolonthinæ) was taken by *Caprimulgus macrurus*; *Anomala* spp. by *Dicrurus ater*, *Oriolus kundoo*, *Crateropus canorus*, *Acridotheres tristis*, *Copsychus saularis*, *Upupa indica*, *Hierococcyx varius*, *Centropus sinensis* and *Brutastu teesa*.

Oryctes rhinoceros is possibly taken by *Brachypternus aurantius* and another species of *Dynastinæ* was found in *Molpastes bengalensis*.

Cetoniinæ.—One species occurred in *Dicrurus ater; Oxycetonia albopunctata* was once taken by *Cuculus micropterus.*

All birds that feed on fairly large insects on the ground, and especially larvæ, will most probably take these Chafers. Birds that follow ploughs, etc., during cultivation operations will certainly pick up a considerable number of these insects and keep down their numbers to a certain extent.

Cicindelidæ.—The Tiger Beetles being for the most part carnivorous are regarded generally as beneficial. They occurred only in very few instances in birds examined and do not form an important item in the diet of any species. Two species of *Cicindela*, namely, *C. aurulenta* and *C. grammophora*, were found in a *Milvus govinda*, but had most probably been eaten by a chicken that the Kite had eaten. Both these species are neutral in feeding habits. *Cicindelidæ* are also on record as eaten by *Francolinus vulgaris* and by *Glareola lactea.*

Carabidæ.—The ground beetles are predaceous and have been as usual regarded as beneficial. One or two species are at times reported as injurious to strawberries, etc., but we have no record of any such or other damage by these insects in India at present. A fair number of birds feed on these beetles, but not habitually nor in preference to other insect food, nor to any marked extent. Many of these beetles are possibly distasteful. Carabids of various species were found in the following birds :—*Corvus splendens, Dendrocitta rufa, Molpastes bengalensis, Dicrurus ater, Oriolus kundoo, Sturnia malabarica, Acridotheres tristis, Ruticilla rufiventris, Calandrella dukhunensis, Merops viridis, Coracias indica, Upupa indica, Caprimulgus macrurus, Hierococcyx varius, Centropus sinensis, Sypheotis bengalensis, Amaurornis phœnicurus, Totanus ochropus, Œdicnemus scolopax* and *Francolinus vulgaris.*

Of identified species taken the following, *Scarites* sp. by *Coracias indica; Tetragonoderus* sp. by *Merops viridis* and *Calandrella dukhunensis; Chlœnius* spp. by *Centropus sinensis* and *Acridotheres tristis; Ch. circumdatus* and *Ch. marginatus* by *Inocotis papillosus; Stenalophus 5-pustulatus* by *Calandrella dukhunensis,*

Macrochilus 3-pustulatus by *Francolinus vulgaris; Pheropsophus bimaculatus* by *Inocotis papillosus.*

Haliplidæ.—These Beetles are very little known, and they have with all other water beetles been regarded as neutral. *Haliplus angustifrons* was taken by *Motacilla borealis.*

Dytiscidæ also neutral. *Hyphoporus aper* was taken by *Totanus glareola, T. ochropus* and *Ardeola grayi; Laccophilus flexuosus* by *Totanus glareola; Corpelatus indicus* by *Brachypternus aurantius; C. pugnax* by *Tringa minuta.*

Hydrophilidæ.—Water Scavengers are neutral. They were found in *Crateropus canorus, Ægithina tiphia, Sitta castaneiventris, Dicrurus ater, Acanthopneuste nitidus, Ruticilla rufiventris, Cyanesecula suecica, Motacilla alba, M. borealis, Anthus maculatus, Liopicus mahrattensis,* and *Totanus glareola; Sphæridium 5-maculatum* in *Acridotheres ginginnianus.*

Staphylinidæ.—The Rove Beetles are predaceous and certainly not in the least injurious in any way. They have been regarded as beneficial. *Phylloscopus tristis* was found to have taken one species, and *Pœdarus variicornis* was once taken by *Dicrurus ater.*

Histeridæ.—Little is known of these beetles, some are predaceous on various insects and others are possibly scavengers. They have here been classed as neutral.

Histerids are apparently seldom taken by birds; they are recorded from *Crateropus canorus, Dicrurus ater, Acridotheres ginginnianus* and *Gallinago cœlestis. Hister bipustulatus* var. *bimaculata* was taken by *Francolinus vulgaris,* as also *H. opacus; H. scissifrons* by *Calandrella dukhunensis.*

Coccinellidæ.—Ladybird Beetles are undoubtedly on the whole beneficial. A few—the genus *Epilachna*—are leaf eaters, and at times injurious to vegetable crops; others again eat fungus spores and may therefore act as an agent for spore distribution. The greater number are well known checks on *Aphidæ* of various species.

These insects are also seldom taken by birds considering how common they are.

Chilomenes sex-maculata was found in *Dicrurus ater* and *Phylloscopus fuscatus; Coccinella septem-punctata* in *Siphia albicilia*, *Merops viridis* and *Coccystes jacobinus; Thea cincta* in *Siphia albicilia; Scymnus nubilans* and *Clanis soror* in *Ægithina tiphia.*

Bostrychidæ.—These Beetles are undoubtedly injurious, doing some damage by boring into timber and wood.

Dinoderus minutus and *Sinoxylon anale* were seen to be taken by *Merops philippinus* and are also probably taken by *M. viridis.*

Malacodermidæ.—The Glow-worms are probably predaceous as well as vegetable feeders, and have been classed neutral. Glow-worms are said to be eaten by *Merula simillimana*, Fireflies by *Sypheotis aurita; Hapalochrus fasciatus* was found in a *Francolinus vulgaris*, *Prionocerus bicolor* in *Oreocincla dauna.*

Elateridæ.—The Click Beetles, though serious pests to various crops elsewhere, have never yet been recorded as such from India. They are regarded as neutral for India. They occurred in most numbers in *Sitta castaneiventris*, and were also taken by *Corvus splendens*, *Crateropus canorus*, *Phylloscopus tristis*, *Ruticilla rufiventris*, *Dicrurus ater*, Common Wagtails, *Calandrella dukhunensis*, *Upupa indica*, *Liopicus mahrattensis*, *Iyngipicus hardwickei*, *Hierococcyx varius*, *Francolinus vulgaris*, *Turnix tanki*, *Gallinago cœlestis*, and the larvæ occurred in numbers in one or two stomachs of *Sarcogrammus indicus.*

Heteroderes sp. was taken by *Dicrurus ater* and *Motacilla beema; Drasterius* spp. by *Anthus maculatus* and *Iyngipicus hardwickei.*

Buprestidæ.—These Wood-borers are several of them pests to forestry and agriculture, and the whole family is to be regarded as injurious.

Eupodotis edwardsi is said to eat Buprestids, and the larvæ have been found in two small wood-peckers *Iyngipicus hardwickei*

and *Liopicus mahrattensis* in several instances *Sphenoptera gossypii* was found to have been taken by *Francolinus vulgaris*.

Tenebrionidæ.—As a class we regard the *Tenebrionidæ* as neutral, most feeding on dead leaves and other vegetable matter. One or two species are, however, now regarded as injurious. This family of beetles is an extremely numerous one, in individuals rather than species, and forms an appreciable proportion of the insects taken by birds for food. Probably any species of bird that takes insects for food takes these insects.

Himatismus sp. is taken by *Geocicla citrina*, *Turnix tanki*; *Œdicnemus scolopax*, and very largely by *Francolinus vulgaris*; *Scleron denticolle* by *Ægialitis dubia*; *S. orientale* by *Crateropus canorus*, *Molpastes bengalensis*, *Dicrurus ater*, *Siphia albicilia*, *Cyanecula suecica*, *Copsychus saularis*, *Motacilla alba*, *Calandrella dukhunensis*, *Francolinus vulgaris* and *Sypheotis bengalensis*.

Opatrum depressum, an injurious species, by *Upupa indica*, *Centropus sinensis*, *Francolinus vulgaris*, *Sypheotis bengalensis*, and *Sarcogrammus indicus*. *Opatrum elongatum* by *Geocicla citrina*; *Penthicus* sp. by *Molpastes bengalensis*, *Acridotheres tristis* and *Francolinus vulgaris*; *Derosphœrus rugicollis* by *Brachypternus aurantius*, *Coracias indica*, *Amaurornis phœnicurus* and *Sypheotis bengalensis*. Other *Opatrum* spp. and other *Tenebrionidæ* are also recorded from nearly all the abovementioned species of birds with the addition of *Corvus splendens*, *Dendrocitta rufa*, *Ægithina tiphia*, *Orthotomus sutorius* *Tephrodornis pondicerianus*, *Acridotheres ginginnianus*, *Sturnopastor contra*, *Hierococcyx varius*, *Taccocua leschenaulti*, *Totanus glareola* and *T. ochropus*.

Mesomorpha villiger is probably taken by nearly all these birds though at present only recorded from 12 species.

Tenebrionidæ do not appear to form the main food of any one species of bird. *Copsychus saularis*, however, feeds at times largely on them and *Himatismus* forms a considerable proportion of the insect food of *Francolinus vulgaris*.

Cantharidæ.—The economic position of these beetles is not at all certain. Some may act as flower fertilizers, others feed on locust eggs, and some are of medicinal value. Some certainly at times do some damage to crops by the destruction of the flowers. They have, therefore, been included as neutral. Birds seldom touch these insects. *Cantharis tenuicollis* and *Mylabris* sp. are taken to some very considerable extent by the two Bustards *Eupodotis edwardsi* and *Sypheotis aurita.*

Monommidæ.—Neutral. *Monomma brunneum* was taken by *Sturnia malabarica.*

Chrysomelidæ.—The leaf-eating beetles are injurious. Some species, perhaps the greater number, are of no real economic importance, but others defoliate plants that are cultivated and are therefore injurious. They appear to be seldom eaten by birds, but, in all probability, occurred in more stomachs examined than is here recorded. They are in some cases softer beetles than most and therefore more readily digested. The Rice Hispa, *H. œnescens*, was found once in *Calandrella dukhunensis ; Oides bipunctata* in *Coccystes jacobinus ; Pachnephorus bretinghami* in *Motacilla alba ; P. impresssus* in *Cyanecula suecica ; Haltica* spp. in *Motacilla borealis* and *Crateropus canorus ; Colaspopoma pulcherrimum* in *Sypheotis bengalensis ;* other species not identifiable in *Oriolus kundoo* and *Merops viridis.*

Cerambycidæ.—The long-horn beetles are entirely wood-borers in the larval form. Agriculturally they are of little importance, though many species are possibly pests from a forestry point of view. They may all without exception be considered injurious.

The Bamboo-borer *Caloclytus annularis* was found in *Perecrocotus peregrinus* and *Tephrodornis pondicerianus.* Wood-peckers are said to take the larvæ of *Hoplocerambyx spinicornis.* Other Cerambycids were found in *Perecrocotus peregrinus* and *Brachypternus aurantius ; Apomecyna pertigera* in *Sarcogrammus indicus.*

Curculionidæ.—The Weevils are, as most common and widely distributed classes of insects, taken by practically every insecti-

vorous bird. Among weevils we have many major pests to crops, etc., and unless we know definitely to the contrary all weevils must be considered as injurious.

Species of *Amblyrrhinus*, *Atmetonychus*, *Balaninus*, *Phytoscopus*, *Astycus*, *Myllocerus* and *Tanymecus* are very commonly eaten by birds, the last three genera being leaf-eaters. *Hypera* and *Rhynchophorus*, boring weevils, are also recorded as taken, the former by Crows and Mynahs, the latter by *Brachypternus aurantius*; Mynahs, Sparrows and Wagtails are said to take the grain pest *Calandra oryzæ*. *Blosyrus asellus* was once taken from *Sypheotis bengalensis*.

Lepidoptera.—This order includes the Butterflies, *Rhopalocera* and the Moths, *Heterocera*, and is one of the largest orders of insects. Amongst them we have some of the worst crop and grain pests and none in India can be said to be beneficial to any marked degree. The only instance of beneficial action is seen in the case of the *Eublemmas* some of which feed on scale insects, which latter are of little economic importance in India. Though not directly beneficial some families are of very great use, notably the Saturniidæ in which family are the Tussar and Eri silk moths, and the Bombycidæ in which is the Mulberry silk moth *Bombyx mori*, in connection with the silk industry.

Butterflies do not form any appreciable proportion of the food of any one species of bird, though a good many birds take these insects at times. A long series of experiments with regard to birds taking protectively coloured or distasteful insects and especially butterflies was made by Mr. Finn, and these are recorded in the Journal of the Asiatic Society. They have little importance to economic ornithology since most of the experiments were conducted with caged birds, these therefore being under unnatural conditions.

The Butterflies include a number of minor pests, of which *Melanitis ismene* was taken by *Merops viridis* and *Papilio pammon* by *Acridotheres tristis*. Other well-known pests are *Pieris brassicæ*, *Virachola isocrates*, and *Papilio demoleus*. *Belenois mesentina* a Pierid

was seen to be taken on one occasion by the King-crow, and *Ilerda sena* by *Passer domesticus*, both of which insects are neutral.

Moths include many major pests of varied habits—defoliators, miners, cut-worms, grain and fabric pests. The larvæ form an inexhaustible supply of insects' food to almost all species of insectivorous birds, and even many species of birds that when mature feed almost, if not quite, entirely on grain and seeds are when in the nest fed very largely on caterpillars by the parent birds.

The hairy caterpillars of the *Arctiidæ* and the *Lymantriidæ* are taken to some considerable extent by the common Hawk-cuckoo, *Hierococcyx varius;* both these families of insects are injurious. The larvæ of *Noctuids*, notably the cut-worms and swarming caterpillars, some of the best-known pests, are taken by a number of different families of birds and form a very general food-supply. Cut-worms (*Agrotis* spp.) are taken especially by the Mynahs, *Upupa indica*, *Hierococcyx varius*, and by Crows; also occasionally by *Copsychus saularis*, Thrushes and Snipe; they probably form a considerable portion of the food of *Inocotis papillosus*. Swarming caterpillars are taken by the same classes of birds; *Chloridea obsoleta* was only found to be taken by *Oriolus kundoo*, but is said to be kept in check on gram in the C. P. by Mynahs and the Rosy Pastor.

Caradrina was found in the stomachs of *Dendrocitta rufa*, *Upupa indica*, *Siphia albicilia*, and *Oriolus melanocephalus;* *Prodenia littoralis* in *Dendrocitta rufa* and *Inocotis papillosus:* and *Spodoptera mauritia* in *Dendrocitta rufa*, *Dicrurus ater*, *Corvus splendens* and *C. macrorhynchus*. Attacks of swarming caterpillars are limited to some extent by Crows and Mynahs; we have one very good instance of this from Balaghat, C. P., and others are on record from Eastern Bengal.

Attacks of *Caradrina exigua* on mangolds and of *Chloridea obsoleta* on gram on the Pusa estate have revealed nothing of nterest.

Though these crops were carefully watched and many specimens of the birds seen feeding in and near these affected crops were shot and examined the insects were not found to be touched. An attack on Castor by *Ophiusa melicerte* showed that *Acridotheres ginginnianus* fed almost entirely on these insects at that time, *A. tristis* and *Corvus splendens* also taking some considerable number; *Ophiusa* has also been noted as taken by *Centropus sinensis* and *Hierococcyx varius*.

Plusia spp. are taken by *Dendrocitta rufa*, *Acridotheres tristis*, and *Siphia albicilia*; *Plecoptera reflexa* by *Dendrocitta rufa*, *Dicrurus ater*, *Tephrodornis pondicerianus*, and *Upupa indica*. *Tarache notabilis* by *Passer domesticus* and *Trigonodes hyppasia* by *Dicrurus ater*.

Moths are generally also taken by Cuculinæ, Phasianidæ, Coraciadæ, Meropidæ and insectivorous birds.

Sphingidæ.—"Birds readily eat the caterpillars when they find them and help to check them when they are numerous." *Theretra oldenlandiæ* larva taken by *Dendrocitta rufa*.

Geometridæ.—*Gnophus collaris* and *Scardamia metallaria* are the only two definitely identified species that have been noticed to be taken by birds in both instances by *Passer domesticus*. The larvæ of this family are mostly defoliators, and though elsewhere some species are serious pests especially to fruit orchards, yet in India no major pest is a geometrid. The larvæ are freely eaten and form a favourite food for nestlings.

Saturniidæ.—To this group belong the Tassar (*Antheræa paphia*) and Eri (*Attacus ricini*) silk-worms. The imagines and eggs of the latter were taken from some Crows, the insects having been picked up off a rubbish heap in a dying condition. *Dendrocitta rufa* was also said to take the worms from the silk house when given facilities for so doing. The Tassar silk-worm larvæ, when kept in the open, are said to be taken by Crows and Mynahs. Silk-worm cocoons are said to be taken by *Aquila hastata*, and Kites take silk-worms thrown away from the silk houses. Birds eat caterpillars of *Antheræa paphia*. (I. M. N.)

Cossidæ.—These insects are injurious to trees of various kinds and are probably taken by most of the borer-eating Woodpeckers. *Tiga javanicus* is said to take the larvæ of *Duomitus ceramicus.*

Bombycidæ.—Important since the silk-worm of the mulberry belongs to this family. They are otherwise possibly injurious, being defoliators. *Ocinara varians* is taken occasionally by *Sturnia malabarica*, *Oriolus kundoo*, and *Coccystes jacobinus.*

Pyralidæ.—A large family containing many well-known major pests to crops, fabrics, etc. The cane pests, *Chilo simplex*, *Anerastia sp.*, *Polyocha* have not been seen to be taken by any bird, whilst *Scirpophaga auriflua*, another cane pest, has been noted to be taken occasionally by the King-Crow. *Ancycolomia chrysographella*, the Rice Caterpillar, is taken by *Dendrocitta rufa*, *Acridotheres tristis*, *Merops viridis* and almost certainly by common Fly-catchers (*Siphia albicilia*) and Wagtails. *Pachyzancla coclesalis?* recorded as taken by *Sturnia malabarica.* Other Pyralids taken to some extent by *Phylloscopus fuscatus*, *Oriolus kundoo*, *Pratincola caprata*, *Tephrodornis pondicerianus*, *Calandrella dukhunensis*, in addition to the birds mentioned above.

Lepidoptera also contain many pests, of which *Gelechia*, *Plutella*, *Anacampsis*, *Anarsia* and *Phthorimæa* are well known. *Phthorimæa operculella* is recorded as taken by *Passer domesticus.*

Laspeyresia jaculatrix is taken by the common crows, and no doubt most insectivorous birds feed on these small moths and the Pyralids. The remains of these small moths are extremely difficult to identify in any bird's stomach and it is in most cases impossible to do so.

Diptera.—Though flies almost certainly form a large percentage of the food of many species of birds, we have few records or references to their being taken.

Culicidæ.—Mosquitoes have not been found in any bird, but are said to be taken by *Terpsiphone parasidi*, *Ripidura* spp., *Anthus*

maculatus, *Amaurornis fuscus*, and *Glareola lactea*. *Melittophaga swinhoei* is said to take both the larvæ and the imagines.

Chironomidæ.—These were taken by *Calandrella dukhunensis*, and gnats and midges are said to be taken by *Hirundines* and *Melittophaga swinhoei*.

Tipulidæ.—Crane-flies were found occasionally in *Phylloscopus tristis*, *Sypheotis bengalensis* and *Sarcogrammus indicus*. The above three families of flies are injurious.

Bibionidæ.—Fever flies were taken by *Phylloscopus tristis*, *Acridotheres tristis* and *Motacilla alba*. They are neutral.

Simulidæ.—The Sand-flies are said to be taken by *Dendrocitta rufa*, and are injurious.

Leptidæ.—Predaceous and possibly therefore beneficial; occurred once in *Francolinus vulgaris*.

Tabanidæ.—The Gad-flies are injurious and are taken by *Sitta castaneiventris*, *Sypheotis aurita*, *Ægialitis dubia* and *Ardeola grayi*, but in these cases I believe that the flies were taken either dead or in a dying condition. *Merops viridis* also eats them.

Anthomyidæ.—Neutral. Habits exceedingly varied, some are pests, others possibly beneficial. Taken by *Calandrella dukhunensis*.

Muscidæ were found to be taken by *Phylloscopus tristis*, *Merops viridis* and *Ardeola grayi*, and *Acridotheres ginginnianus*. *Stomoxys* by *Calendrella dukhunensis*.

Pupæ of *Diptera* were taken in a few instances from the stomachs of *Francolinus vulgaris*, *Upupa indica* and *Coccystes jacobinus*.

The classes of birds which particularly take Flies are the Swallows, Martins and Swifts, the Wagtails, Fly-catchers, Bee-eaters, and also the Sun-birds (*Nectarinidæ*).

HEMIPTERA.—

The *Heteroptera* or Bugs form a fairly general food for birds; but it is possible that a good number of species are distasteful, this is most possibly the reason why we have no records of birds taking the Rice Bug—*Leptocorisa varicornis*. It is possible that

the greater number of species are injurious, but some being predaceous play an important part in checking caterpillars, etc., and are therefore beneficial.

We must therefore class the sub-order as neutral.

The Pentatomidæ are for the most part vegetable feeders, some few, none of which have been taken from birds, being predaceous chiefly among the Amyoteinæ.

Bagrada picta, a well-known pest, is taken occasionally by *Acridotheres tristis* and *Anthus maculatus ; Nezara viridula* also a pest is taken by *Graucalus macii*, *Ruticilla rufiventris*, *Brachypternus aurantius*, *Upupa indica*, and *Francolinus vulgaris*. The *Cydninæ* are included as injurious though but little is as yet known of their habits. They do not form an appreciable proportion of any bird's food, but are taken by a fair variety of species. *Cydnus* spp. were taken by *Anthus maculatus*, *Calandrella dukhunensis*, *Graucalus macii*, *Ruticilla rufiventris*, *Brachypternus aurantius*, *Upupa indica*, and *Francolinus vulgaris*, *Cydnus nigritus* by *Crateropus canorus*, *Molpastes bengalensis*, *Graucalus macii*, *Siphia albicilia*, *Ruticilla rufiventris*, *Motacilla personata*, *M. beema*, *Anthus maculatus*, *Arachnechthra asiatica*, *Upupa indica*, *Francolinus vulgaris*, *Sarcogrammus indicus*, and *Gallinago cœlestis ; Cydnus varians* by *Crateropus canorus* and *Francolinus vulgaris ; Chrysocoris alba var. pallens* by *Motacilla alba ; Storthecoris nigriceps* by *Francolinus vulgaris*.

Coreidæ.—This family is in all probability entirely herbivorous, sucking out the juices of plants. *Leptocorisa* is a member. They may be classed as injurious.

Clavigralla horrens, which sucks the sap of *Cajanus indicus* and may possibly be injurious, was taken by *Francolinus vulgaris ; Homœocerus inornatus*, which feeds on trees (possibly injurious), was taken by *Graucalus macii*.

Lygœidæ.—Practically nothing is known of the food of this family, and they must therefore be classed as neutral. *Lygœus hospes* was taken by *Oriolus kundoo* and *O. melanocephalus*, both

of which birds show perhaps a slight preference to *Hemiptera* as food; *Lygæus* sp. by *Dicrurus ater*, *Oriolus kundoo* and *Hierococcyx varius*; *Graptostethus servus*, *G. dixoni* and *G. nigriceps* by *Francolinus vulgaris*. All these species of insects are neutral.

Pyrrhocoridæ.—Only one injurious species is known, namely, *Dysdercus cingulatus*, the Red Cotton Bug, which is taken by *Sitta frontalis*, by *Hierococcyx varius*, and fairly frequently by *Oriolus kundoo* and *O. melanocephalus*.

Dermatinus lugubris, a neutral species, was taken freely by *Francolinus vulgaris*; some Pyrrhocorids were taken from the stomach of *Cotile sinensis*.

Homoptera contain the Fulgorids, Membracids, Jassids, Aphids and Coccids. Most of these are injurious as classes.

Fulgoridæ.—*Lawana conspersa*, included as injurious though possibly only a wild plant feeder, was taken by *Oriolus kundoo* and *Coracias indica*. *Pyrilla aberrans*, a cane pest, is said to have been eaten in large numbers by some small birds, most probably some species of *Phylloscopus*, during the cold weather of 1906 at Pusa.

Membracids and Jassids are all to some extent injurious. They are both taken by *Francolinus vulgaris*, the latter being also taken by *Sitta castaneiventris*. It is more than probable that many of the Warblers and Tits take this class of insect-food to some considerable extent.

Aphids are injurious. They occurred in the stomachs of some Wagtails (*Motacillidæ*) and are most probably taken by birds that frequent trees and bushes and especially by the *Sylviidæ*, *Certhiidæ* and *Fringillidæ*. *Aphis gossypii* was found to be taken in numbers by *Phylloscopus tristis*.

Coccidæ.—The scale insects, though not of so much importance in India as in other countries, are undoubtedly injurious. They have been recorded in very few instances from birds, but in all probability, where small birds are common and where these insects

occur, they are largely eaten and perhaps kept in considerable check by the agency of these birds.

Monophlebus octocaudata was taken by *Cuculus macrurus*, *Dicrurus ater*, *Liopicus mahrattensis*, *Upupa indica* and *Francolinus vulgaris*, this latter bird also taking a species of *Pulvinaria*. *Tachardia lacca*, the lac insect, is of considerable importance commercially in this group of insects, and though there is some considerable cultivation of this insect at Pusa, on only one occasion has a specimen been taken from a bird, namely, *Liopicus mahrattensis*. No other birds have been noticed to feed on this insect, though some, notably *Brachypternus aurantius*, habitually feed on ants found and captured on the trees on which the lac is cultivated.

INDEX TO INSECTS' NAMES.

The economic importance of the insects mentioned in this paper is stated here as follows :—

B. = Beneficial. I. = Injurious.
N. = Neutral. U. = Useful.

A

Acantholepis fraunfeldi var. *bipartita*. *Formicidæ*. N.
Acridiidæ. Locusts, Grasshoppers, &c. *Orthoptera*. I.
Acridium æruginosum. *Acridiidæ*. I. (1022).
Agrotis flammatra. *Noctuidæ*. I.
Agrotis spinifer. *Noctuidæ*. I.
Agrotis ypsilon. *Noctuidæ*. I.
Amblyrrhinus poricollis. *Curculionidæ*. I.
Ancylolomia chrysographella. *Pyralidæ*. I.
Anomala pallida. *Melolonthidæ*. I.
Anomala varians. *Melolonthidæ*. I.
Anomala viridis. *Melolonthidæ*. I.
Anthophila. Bees. *Hymenoptera*. B.
Anthomyiidæ. *Diptera*. N.
Ant Lions. *Myrmeleo*. B.
Ants. *Formicidæ*. N.
Aphanus sordidus. *Lygæidæ*. I.
Aphis gossypii. *Aphidæ*. I.
Aphidæ. Plantlice. *Hemiptera Homoptera*. I.
Aphodiidæ. *Coleoptera*. N.
Aphodius marginellus. *Aphodiidæ*. N.
Apidæ. Bees. B.
Apis florea. *Apidæ*. B.
Apis indica. *Apidæ*. B.
Apis mellifica. *Apidæ*. B.
Apogonia carinata. *Melolonthidæ*. I.
Apomecyna pertigera. *Cerambycidæ*. I. (1431).
Astycus lateralis. *Curculionidæ*. I.
Atmetonychus peregrinus. *Curculionidæ*. I.
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B

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Balaninus sp. *Curculionidæ*. I.
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Buprestidæ. *Coleoptera*. I.
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Catharsius sabæus. *Scarabæidæ*. N.
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Chelisoches melanocephalus. *Forficulidæ*. N.
Chilomenes sexmaculata. *Coccinellidæ*. B.
Chironomidæ. Gnats or Midges. *Diptera*. I.
Chlænius circumdatus. *Carabidæ*. B.
Chlænius marginatus. *Carabidæ*. B.
Chlænius spp. *Carabidæ*. B.
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Chrysis sp. *Chrysidæ*. *Hymenoptera*. I.
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Chrysomelidæ. Leaf beetles. *Coleoptera*. I.
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G

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Lygæidæ. Hemiptera Heteroptera. N.
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Lymantriidæ. Heterocera. I.

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Macrochilus tripustulatus. Carabidæ. B.
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Opatrum spp. *Tenebrionidæ.* N.
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Phidole malinsi. *Formicidæ.* N.
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Platygomphus dolobratus. *Odonata.* B.
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Pyrrhocoridæ. *Hemiptera Heteroptera.* Bugs. I.

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Rhopalocera. Butterflies. *Lepidoptera.* I.
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Rhynchophorus ferrugineus. *Curculionidæ.* I.
Rhyothemis variegata. *Odonata.* B.
Rhyssemus germanus. *Aphodiinæ.* N.

S

Saturniidæ. Silk-worms. *Heterocera.* I. and U.
Scale insects. *Coccidæ.* I.

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Scirpophaga auriflua. Pyralidæ. I.
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Scleron orientale. Tenebrionidæ. N.
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Serica lugubris. Melolonthidæ. I.
Simulidæ. Sand-flies. *Diptera.* I.
Sinoxylon anale. Bostrychidæ. I.
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Sphegidæ. Wasps. *Hymenoptera.* N.
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Spodoptera mauritia. Noctuidæ. I.
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Stizus vespiformis. Sphegidæ. N.
Stomoxys sp. *Muscidæ.* I.
Storthecoris nigriceps. Pentatomidæ. N.

T

Tabanidæ. Gad-flies. *Diptera.* I.
Tachardia lacca. Coccidæ. U.
Tanymecus indicus. Curculionidæ. I.
Tanymecus hispida. Curculionidæ. I.
Tarache notabilis. Noctuidæ. I.
Tenebrionidæ. Coleoptera. N.
Termitidæ. Neuroptera. I.
Tetragonoderus sp. *Carabidæ.* B.
Thea cincta. Coccinellidæ. B.
Tineidæ. Heterocera. I.
Tiphia sp. *Scoliidæ.* N.
Tipulidæ. Crane-flies. *Diptera.* I.
Tridactylinæ. Gryllidæ. N.
Trigonodes hyppasia. Noctuidæ. I.
Trithemis pallidinervis. Odonata. B.
Trox spp. *Troginæ.* N.
Troginæ. Coleoptera. N.
Tryxalis sp. *Acrididæ.* I.

V

Vespa orientalis. Vespidæ. N.
Vespidæ. Wasps. *Hymenoptera.* N.

W

Water scavengers. *Hydrophilidæ.* N.
Weevils. *Curculionidæ.* I.
White ants. *Termitidæ.* I.

X

Xylocopa dissimilis. Aphidæ. B.

Z

Zygopterides. Odonata. B.

IV. THE VALUE OF BIRDS TO AGRICULTURE.

In the above pages are given in very full detail the records on the food of birds generally and the detailed contents of the stomachs of birds shot at Pusa, in the middle of a very intensely cultivated agricultural tract where it might be supposed we could form some idea of the value of the birds from the economic standpoint. The final object of the enquiry was to elicit definite facts on the beneficial or other influence of the birds as a whole and of each common bird; while the very large mass of recorded information collected above is of value and was hitherto scattered, it is of far less value than the actual recognition of the exact species of insects eaten coupled with an estimate of the position of each insect which has now only become possible as a result of the entomological work at Pusa and with the resources in identifying and placing insects which this section affords. Jerdon's remark, for instance, on the food of *Hierococcyx varius*, the Common Hawk Cuckoo, is "On Caterpillars, and other insects and on fruits. It is very fond of the fig of the banyan and other *Fici.*" This, while valuable, is not so definite as the summary now made possible on the actual identification specimen by specimen of 300 insects taken by 17 birds, where we find one insect to be beneficial, 253 injurious and 46 neutral. In discussing the birds, therefore, from their value in agriculture, I am limiting myself to those of which there are actual stomach records since we must inevitably come down to estimating the value of the bird by the actual value we place upon each insect, a matter very much of personal opinion but which must be based upon an intimate knowledge of the place, the insects' habits and the local agricultural practice. A list of the birds of which there are stomach records is attached, with its value (in my opinion) shown.

PASSERES.

CORVIDÆ.		
	Corvus macrorhynchus. Jungle Crow.	Beneficial.
	The balance is in favour of this bird, the insects it eats being destructive ones feeding on germinating crops. It is on the other hand injurious by digging up seeds but as every *Astycus* and *Chrotogonus* eaten would probably have destroyed hundreds of seedlings, the insect-eating aspect is by far the more valuable.	
	Corvus splendens. Indian House Crow.	Beneficial.
	The five of the 20-6-09, eating *Ophiusa melicerte* show how difficult it is to judge from stomachs; had these birds not been included, the injurious aspect of this bird would have outweighed the beneficial. Personally I hold that the beneficial action of this bird in disposing of insects of this sort when they are abundant outweighs its injurious action.	
	Dendrocitta rufa. Indian Tree-Pie.	Beneficial.
	Distinctly beneficial.	
PARINÆ.	*Parus atriceps.* Indian Grey Tit.	Beneficial.
	A very beneficial species. Any bird that specialises on *Myllocerus* and *Tanymecus* deserves the greatest encouragement.	
CRATEROPODIDÆ.	*Crateropus canorus.* The Seven Sisters. Jungle Babbler.	Beneficial.
	Distinctly beneficial.	
	Zosterops palpebrosa. Indian White-eye.	Beneficial.
	Injurious insects are eaten, the vegetable matter taken being unimportant.	
	Aegithina tiphia. Common Tara.	Beneficial.
	The injurious insects eaten are important ones.	
	Molpastes bengalensis. Bengal Redvented Bulbul.	Beneficial.
	Very clearly beneficial and should be vigorously protected and encouraged.	
SITTIDÆ.	*Sitta castaneiventris.* Chestnut-bellied Nuthatch.	Beneficial.
	The food is insect, many destructive species probably being eaten.	
DICRURIDÆ.	*Dicrurus ater.* The King-Crow.	Beneficial.
	The food is largely destructive insects and the bird is most valuable.	
SYLVIIDÆ.	Warblers.	
	Orthotomus sutorius. Indian Tailor Bird.	Beneficial.
	Cisticola cursitans. Rufous Fantail-Warbler.	Beneficial.
	Phylloscopus tristis. Brown Willow-Warbler.	Beneficial.
	Phylloscopus fuscatus. Dusky Willow-Warbler.	Beneficial.
LANIIDÆ.	*Lanius cristatus.* Brown Shrike.	Beneficial.
	A bird that feeds on *Chrotogonus* and *Myllocerus* is beneficial.	
	Pericrocotus peregrinus. Small Minivet.	Beneficial.
	Graucalus macii. Large Cuckoo-Shrike.	Beneficial.
	Fed almost wholly on injurious insects.	

ORIOLIDÆ.	Orioles.	
	Oriolus kundoo. Indian Oriole.	Beneficial.
	Feeds on injurious insects and wild fig fruits. Distinctly beneficial.	
	Oriolus melanocephalus. Black-headed Oriole.	Beneficial.
	Like the last.	
STURNIDÆ.	Mynahs and Rosy Pastors.	
	Pastor roseus. Rosy Pastor.	Injurious.
	Whether one ranks this bird as beneficial or not must depend on the relative importance one attaches to its destruction of locusts and of grain. My personal opinion, based on what I have seen of its feeding on locusts, is that its beneficial action is very much exaggerated and I rank it as very injurious bird. When locusts do come, they come in such vast numbers that even with small hoppers of which each bird can eat a number, the flocks of Rosy Pastors do no appreciable good and by scattering the swarms make destruction of swarms very much more difficult.	
	Sturnia malabarica. Grey-headed Mynah.	Beneficial.
	Acridotheres tristis. Common Mynah.	Beneficial.
	On the whole, beneficial in my opinion and distinctly to be encouraged.	
	Acridotheres ginginnianus. Bank Mynah.	Beneficial.
	Sturnopastor contra. Pied Mynah.	Beneficial.
MUSCICAPIDÆ.	Fly-catchers.	
	Siphia albicilia. Eastern Red-breasted Fly-catchers.	Beneficial.
TURDIDÆ.		
	Ruticilla rufiventris. Indian Redstart.	Beneficial.
	Cyanecula suecica. Indian Blue-throat.	Beneficial.
	Copsychus saularis. Magpie Robin.	Beneficial.
	Geocichla citrina. Orange-headed Ground-thrush.	Beneficial.
PLOCEIDÆ.	Weaver-birds and Munias.	
	Ploceus baya. Baya.	Neutral.
	Uroloncha malabarica. White-throated Munia.	Neutral.
FRINGILLIDÆ.		
	Gymnorhis flavicollis. Yellow-thoated Sparrow.	Beneficial.
	Passer domesticus. House Sparrow.	Injurious.
	The evidence is against this bird, no good reason existing for its protection and several against.	
HIRUNDINIDÆ.		
	Cotile sinensis. Indian Sand Martin.	Beneficial.
MOTACILLIDÆ.	Wagtails and Pipits.	
	Motacilla alba. White Wagtail.	Beneficial.
	Motacilla personata. Masked Wagtail.	Beneficial.
	Motacilla borealis. Grey-headed Wagtail.	Beneficial.
	Motacilla beema. Indian Blue-headed Wagtail.	Beneficial.
	Anthus maculatus. Indian Tree Pipit.	Beneficial.
	Anthus rufulus. Indian Pipit.	Beneficial.

ALAUDIDÆ.	Larks.	
	Calandrella dukhunensis. Rufous Short-toed Lark.	Beneficial.
	A markedly beneficial bird that should be protected and not eaten as an "Ortolan."	
	Mirafra erythroptera. Red-winged Bush-Lark.	Beneficial.
NECTARINIDÆ.	Sun-birds.	
	Arachnechthra asiatica. Purple Sun-bird.	Beneficial.
PICI.		
PICIDÆ.		
	Liopicus mahrattensis. Yellow-fronted Pied Woodpecker.	Beneficial.
	Iyngipicus hardwickei. Indian Pigmy Wood-pecker.	Beneficial.
	Micropternus phæoceps. Northern Rufous Woodpecker.	Neutral.
	We class these ants which are its food as neutral.	
	Brachypternus aurantius. The Golden Backed Wood-pecker.	Beneficial.
	Iynx torquilla. The Common Wryneck.	Beneficial.
ZYGODACTYLI.		
CAPITONIDÆ.		
	Thereiceryx zeylonicus. Common Indian Barbet.	Injurious.
	A destructive species.	
	Xantholæma hæmatocephala. Crimson-breasted Barbet. Eats fig fruits.	Neutral.
ANISODACTYLI.		
CORACIIDÆ.		
	Coracias indica. Indian Roller or Blue-Jay.	Beneficial.
	The analysis of its food shows it to be distinctly beneficial.	
MEROPIDÆ.	Bee-eaters.	
	Merops viridis. Common Indian Bee-eater.	Injurious.
	Distinctly injurious.	
	Merops philippinus. Blue-tailed Bee-eater.	Injurious.
	Distinctly injurious by destroying beneficial insects.	
ALCEDINIDÆ.	King-fishers.	
	Halcyon smyrnensis. White-breasted King-fisher.	Beneficial.
BUCEROTIDÆ.	Hornbills.	
	Lophoceros birostris. Common Grey Hornbill. Feeds on figs.	Neutral.
UPUPIDÆ.	Hoopoes.	
	Upupa indica. Hoopoe.	Beneficial.
	Clearly beneficial.	
MACROCHIRES.		
CAPRIMULCIDÆ.	Night Jars.	
	Caprimulgus macrurus. Horsfield's Night Jar.	Beneficial.
	Distinctly beneficial.	
COCCYGES.		
CUCULIDÆ.	Cuckoos.	
	Hierococcyx varius. Common Hawk Cuckoo.	Beneficial.
	Distinctly beneficial as feeding on injurious insects.	
	Coccystes jacobinus. Pied Crested Cuckoo.	Beneficial.
	Distinctly beneficial.	

	Eudynamis honorata. Koel. Feeds on useless fruits.	Neutral.
	Taccocua leschenaulti. Sirkeen Cuckoo. Fed on *Opatrum*, which though a harmless insect in Pusa, is elsewhere destructive to potatoes.	Beneficial.
	Centropus sinensis. Common Coucal or Crow-pheasant. Doubtfully beneficial.	Beneficial.
PSITTACI.	Parrots.	
PSITTACIDÆ.		
	Palæornis torquatus. Rose-ringed Parroquet. "The greatest bird-pest we have in India."	Injurious.
STRIGES.	Owls.	
	Athene brama. Spotted Owlet. The stomach records are too few for any definite conclusion, but the evidence is in favour of its being beneficial.	Beneficial.
ACCIPITRES.		
FALCONIDÆ.		
	Butastur teesa. White-eyed Buzzard Eagle.	Beneficial.
	Haliastur indus. Brahminy Kite. Distinctly beneficial.	Beneficial.
	Milvus govinda. Common Pariah Kite. Distinctly beneficial, except that it eats chickens.	Beneficial.
	Astur badius. Shikra.	Beneficial.
	Pernis cristatus. Crested Honey Buzzard.	Beneficial.
COLUMBÆ.		
COLUMBIDÆ.	Pigeons and Doves.	
	Crocopus phœnicopterus. Bengal Green Pigeon.	Neutral.
	Turtur suratensis. Spotted Dove.	Injurious.
	Turtur risorius. Indian Ring Dove.	Injurious.
GALLINÆ.		
PHASIANIDÆ.		
	Francolinus vulgaris. Black Partridge.	Beneficial.
HEMIPODII.		
	Turnix tanki. Indian Button Quail.	Beneficial.
GRALLÆ		
RALLIDÆ.		
	Amaurornis phœnicurus. White-breasted Water-hen.	Beneficial.
OTIDIDÆ.		
	Sypheotis bengalensis. Bengal Florican. I cannot class this, one *Polistes* is worth how many *Chrotogonus?*	?
LIMICOLÆ.		
OEDICNEMIDÆ.		
	Oedicnemus scolopax. Stone Curlew.	Beneficial.
CHARADRIIDÆ.		
	Sarcogrammus indicus. Red-wattled Lapwing.	Beneficial.
	Hoplopterus ventralis. Indian Spur-winged Plover.	
	Aegialitis dubia. Little Ringed Plover.	Neutral.

	Totanus glareola. Wood Sandpiper.	?
	Totanus ochropus. Green Sandpiper.	?
	Totanus calidris. Redshank.	Neutral.
	Tringa minuta. Little Stint.	Neutral.
	Gallinago cœlestis. Common Snipe.	Beneficial.
TEGANOPODES.		
PHALACROCORACIDÆ.	Cormorants.	
	Phalacrocorax javanicus. Little Cormorant. Eat fish only.	Neutral.
HERODIONES.		
IBIDIDÆ.		
	Inocotis papillosus. The Black Ibis. In my opinion a very destructive bird for eating frogs which themselves eat so many injurious insects.	Injurious.
ARDEIDÆ.	Herons.	
	Bubulcus coromandus. Cattle Egret.	Beneficial.
	Ardeola grayi. Pond Heron. Feeds on Dragonflies.	Injurious.
ANSERES.		
	Quercedula circia. Garganey or Blue-winged Teal.	Neutral.

In the main the birds common in Pusa are from our point of view beneficial. I would protect the crows, though 8 ate frogs, because of their feeding on *Chrotogonus*, the very destructive surface grasshopper, but I admit I would like to have 10 stomachs daily throughout a whole year on which to form a better estimate. Mr. Mason does not hold this opinion, "crows cannot be definitely classed as beneficial and require if any thing to have their numbers kept within certain limits as is the case with *C. frugilegus* in England." Having to deal less with birds and more with the insects like *Chrotogonus*, I may attach too much importance to the insect-eating function of this bird and clearly there is room for two opinions.

The Indian Tree Pie and Indian Grey Tit are clearly beneficial and are not probably capable of protection or encouragement. Man does not affect them.

The same applies to the Seven Sisters, the White-eye, the Common *Ioras*, the Bulbul, and the Nuthatch, all useful small birds whose function is a very important one and which require probably neither protection nor encouragement. The King-Crow is a most important bird, far more so than the records seem to me to

show. In some parts of the country branches are put up in paddy-fields to afford resting-places to this bird, which is dependent upon them; this is a custom I would like to see extended to all paddy areas; paddy as a crop offers no resting-place to such a bird, nor can ground feeding birds feed in it; it has also (? therefore) abundant pests and its worst are just the sort of insects the King-Crow takes, *i.e.*, insects it catches flying.

For other crops, its importance is perhaps less, but for paddy it should be helped in every way.

The Warblers and Shrikes are clearly beneficial in a general way. The Orioles are beneficial and deserve protection. The Mynahs do also, except the Rosy Pastor which I rank as a most injurious bird. The common Mynah I would encourage particularly, mainly by planting fig trees of all sorts (Pipal, baryar, gular, etc.), as avenue trees always where possible; the good done by mynahs far outweighs every other consideration, only those in India who have to do with road planting know nothing of birds. It is not uncommon to plant mangoes for fruit and timber, it would be better to plant figs for birds that keep down surplus insects and bring good crops.

The Flycatchers, Redstarts, Blue-throat, Magpie-robin and Ground-thrush are all beneficial, while the Weaver-birds and Munias are neutral. The Yellow-throated Sparrow does good, the House Sparrow I class as injurious and by no means worthy of protection. Opinions differ about the common house sparrow, but I emphatically rank it as injurious from man's point of view. Of the Martins and Swallows we really know nothing in India; what it is they get when feeding, high up in the air, it would be very interesting to know.

The Wagtails, Pipits and Larks are all deserving of protection. In particular the Rufous Short-toed Lark (*Calandrella dukhunensis*) so often destroyed as an Ortolan should be protected and not destroyed as it at present is. This is a bird that feeds on weevils (*Tanymecus* and *Myllocerus*) and on the "Fatinga" or surface grasshopper, all insects that do a great deal of harm. You eat a dish of ten Ortolans and you eat birds that daily eat, probably at least 50 destructive insects apiece, or 15,000 destructive insects per month

survive as the result of your dish of Ortolans. Personally I would put a high penalty on the destruction of Ortolans.

The Wood-peckers are beneficial partly by feeding on insects attacking trees, partly by destroying the many insects which hibernate or rest in the cracks of the bark (*e.g.*, *Myllocerus discolor*).

The common Indian Green Barbet is distinctly injurious to fruit especially and requires to be kept down. The Crimson-breasted Barbet appears to be neutral, eating the fruits of wild figs, but these have some economic value as food, and the Barbets as a whole seem to have no good points. The Indian Roller or Blue-jay on the other hand is a most beneficial bird and one of the commonest in the plains. It is one that likes a perch from which to float down on to its prey, and could be encouraged. Above all, its destruction should be met with the heaviest penalties, as its bright plumage exposes it to attack.

The common Indian Bee-eater is a beneficial bird, *except in regard to bees*. Our attempts to make bee-keeping in bar-frame hives a success have been largely frustrated by these birds. In general the bird is beneficial, but to those attempting bee-keeping the bird is an enemy. The Blue-tailed Bee-eater is directly injurious from the agricultural point of view and does not deserve protection. The Hoopoe is deserving of protection in its strongest form and only a confirmed bird-maniac would shoot a Hoopoe. The Night Jars and the Cuckoos we rank as beneficial, while the Koel is neutral. The Crow-Pheasant is very doubtful, it does good and does harm, and probably does not stand in need of protection.

The Parroquets are deserving of no protection at all but of utter extermination, and all the nonsense written about their "extermination" by ignorant people in England is based on an entire ignorance of India. There is no more destructive bird to the crops than the parroquet and the cultivator is powerless against it.

The Owls are beneficial, the Barn Owl eating mice, the Spotted Owlet eating insects, including *Chrotopsonus*, the destructive surface

grasshopper. The white-eyed Buzzard Eagle and the Brahminy Kite are beneficial, the common Pariah Kite also, except where fowls are kept, and the Shikra and Crested Honey Buzzard are beneficial.

Of the Doves and Pigeons, the Bengal Green Pigeon is neutral, the Spotted Dove and Indian Ring Dove injurious, though of little importance. They are shot for food to a very slight extent and probably are of no economic importance. The Black Partridge is distinctly beneficial and deserves protection, while the Button Quail is less distinctly beneficial. The White-breasted Waterhen is beneficial, the Bengal Florican is doubtful, though insect-eating, as there are not sufficient stomachs to decide what proportion of its food is injurious. The Stone Curlew and Red-Wattled Lapwing are beneficial, the Indian Spur-winged Plover neutral, the Little Ringed Plover and the Sandpipers doubtful, the Redshank and Little Stint neutral, while the common Snipe is mildly beneficial but not important.

Of the Ibises, Storks, Herons, etc., the Black Ibis I rank as an injurious bird, but I admit this to be open to opinion as the frogs it eats are balanced by such insects as *Agrotis* and *Prodenia* and as the frogs' value is by no means certain, there is no definite case either way on the evidence, perhaps, and the same applies to the Common Herons, in this case feeding on frogs. The Cattle Egret is a markedly beneficial bird deserving of protection, while the Pond Heron is distinctly not beneficial by feeding largely on Dragonflies. Of the Swans, Ducks and Geese, the Garganey or Blue-winged Teal is neutral, as are probably all its allies from our point of view.

In considering this question from the agricultural aspect, in a tract such as Behar, the conclusion one comes to is that there are large numbers of common birds which are extremely beneficial, which deserve protection, and which in the main are not affected by man at all. They neither need protection nor can they be encouraged. There are, however, exceptions : the Indian Roller or Blue Jay is shot to some extent on account of its plumage ; it should be rigidly protected and the export of its skins prevented. The birds

eaten as Ortolans should be protected, if protection is possible; their value as food is totally insignificant as compared with their value to agriculture. Crows are not destroyed probably to any great extent. The King-Crow could probably be very greatly helped in paddy lands by the provision of perches, and this probably applies to other crops not tall enough to act as perches for them. The Mynahs could probably be very much encouraged by planting trees of the *Ficus* genus, such as the Pipal, Baryar, Gular, Pakour, etc., as roadside trees, which supply food and shelter, and which help to maintain such a number of birds that when an outbreak of a pest occurs, the birds are there to eat the insects.

For the Hoopoe, Spotted Owlet, and the Kites, no protection is probably needed or practicable. The Black Partridge is shot, but the number shot in so large an area as India must be a very insignificant one. The Cattle Egret is the only bird other than the Indian Roller coming among those of first class importance to agriculture, among those here dealt with, which requires protection. The Egrets are said to be destroyed in very large quantities during the breeding season on account of the train of pectoral feathers valued as decorations. It is not certain how far other Egrets are valuable; this one has an undoubted agricultural importance and deserves protection. It and the Indian Roller are the only two birds among those exported (see p. 23 above) which are distinctly known to be beneficial. On the other hand, the Black Ibis, the Pond Heron and other frog-eating birds are probably injurious from our point of view, while the Egrets proper (*Herodias* spp.) are of very doubtful importance in agriculture. The Rose-ringed Parroquet and probably all parroquets are extremely destructive, and it is undoubtedly for the good of India that they are killed, though the export of their skins is forbidden and they are shipped as "Cowhair" to Singapore for re-shipment to England. To anyone who has lived in the plains and seen the havoc wrought on fruit, on maize and other crops, even on the leaves of trees, such as teak, by parroquets, it will be incomprehensible that the export of their plumage is forbidden. No

bird is so destructive in Behar as the Rose-ringed Parroquet, and there is not a word to be said in its favour.

Of other destructive birds, which should be destroyed, the Bee-eaters, the House-sparrow and the common Indian Green Barbet are the only ones included in the birds investigated here and which occur commonly in Behar.

What is the economic value of these birds which live in densely cultivated areas, such as Behar ? One has only to read the lists of the food of the beneficial species to get an idea of the immense part they play in reducing insect damage. Nearly all insects have *special enemies* such as parasites which attack each individually, but which produce alternative abundance and scarcity of each insect; that is, with the natural action of the special checks such as parasites, you get alternate "Waves" of insect pest and parasite; this is where the birds' importance is shown; they are not restricted, they eat many kinds of insects and when a pest has for the time got ahead and is abundant, the birds are there to feed on it just because it is abundant and because at one time one is abundant, at another time another is, and the birds eat them all. To put it figuratively they cut off the tops of the waves and tend to keep them all at a uniform level, none being ever destructively abundant. In my opinion from man's point of view this is the special function in nature of birds and if the bird population is small, outbreaks of insects are frequent. To gain a better idea of their action read over the groups of insects they eat (pp. 323-345). Locusts and grasshoppers are all injurious and "they are eaten by practically every species of insectivorous bird and form one of the main supplies from which birds in India draw their food." We have only one record of a bird taking a mantis which is usually a beneficial insect. The injurious bherwa (*Schizodactylus monstrosus*) is taken by many birds as also are the injurious crickets. Termites (White-ants) are, when they emerge from the nest in the flying state, eaten voraciously and probably few escape. Yet every one of these flying females is capable of starting a new nest if it can escape long enough to burrow into the soil, and undoubtedly the birds destroy an enormous per-

centage. The pheasants, partridges, quail, jungle fowl and other *Phasianidæ* are known to feed on them at all times, even "scratching in the nests" to get them.

It is extremely significant that there is no record of one of the Parasitic Hymenoptera, the Ichneumons, as food of our birds; they are the direct checks on insect attack and are nearly all parasites. They are extremely abundant and apparently *wholly untouched by birds*, while they are the greatest direct check on insect increase we have; were birds addicted to feeding on them, it would be extremely hard to assess their value and *it immensely increases the value of birds that they do not feed on them.* Of the wasps, ruby-wasps, and digger wasps, which in the main are beneficial, there are a few records but not a large amount. For the bees, the Bee-eaters are very destructive and we have no good word to say for these birds. As a rule, the bees, wasps and ruby-wasps are not eaten and are more or less immune, which, as most are beneficial, is to the credit of the birds. Many birds feed on ants but, while ants do good, they also do harm, and a world overrun by unchecked ants would be unbearable to man.

Birds feed largely on Dung-beetles which we here regard as neutral; they feed also on Cockchafers which are distinctly destructive, and fortunately they feed on the grubs turned up by the plough, this being the destructive stage.

A few birds feed on Cicindelids while many feed on Carabids, both beneficial groups probably and both extremely abundant. Of the very abundant Coccinellids (Lady-bird beetles), very few are found to be eaten by birds, probably partly owing to their habits and small size, and partly to their distastefulness. Coccinellids are usually found on leaves, feeding on plant-lice, etc., and birds cannot as a rule get insects off leaves unless by hovering, as they have no support while feeding; this is a point of very great importance in considering what birds eat; ground insects are easily preyed on by birds, but insects on leaves are not since the bird cannot perch on the leaf and must either make a dart or hover; when an outbreak of caterpillars occurs, the birds do not gather till the caterpillars

descend to pupate ; as soon as the caterpillars come down to the soil, the birds can get them and until then they seem to pay little attention to them. We have noticed this markedly in outbreaks of caterpillars on crops such as castor ; the caterpillars are quite safe so long as they are on the large, thin leaves ; but as soon as they descend the Mynahs and Hoopoes are after them in great numbers. Coccinellids never need to come down as they pupate on the leaves and the beetles and larvæ feed on the insects on leaves as a rule.

The Buprestids are of less importance to agriculture than to forestry, but the fact that the Black Partridge feeds on the cotton stem-borer (*Sphenoptera gossypii*) is worth noting. Several birds feed on *Opatrum depressum*, a species now known to be destructive to gram, potatoes, etc., and the various Tenebrionids, so common on the soil, are the food of many birds. Most are harmless, but the birds are probably an important check on them. Cantharids are not eaten except by bustards ; their economic importance is very doubtful.

Considering their enormous number, the Chrysomelids are very little eaten and it is surprising that so few Cerambycids are found. Weevils are taken by practically every "insectivorous bird" and are of very great economic importance, being destructive in very many cases and never beneficial. Several of our important pests are of this family and the fact that such weevils as *Tanymecus*, *Myllocerus*, and *Rhynchophorus* are eaten is significant.

In the Lepidoptera, Butterflies and Moths, we find the greatest food of birds in the countless caterpillars eaten, not one of which can be reckoned as beneficial with the sole exception of the wild tusser caterpillars, while many are extremely destructive pests. Here we would draw special attention to a point nearly always ignored by writers, the fact that birds cannot get the caterpillars on many crops until the caterpillars come down to the soil. Watch caterpillars on castor, for instance ; they are practically untouched till they are full grown because the bird can get no foot-hold on the leaf, and the caterpillar from hatching to maturity rests on the leaf. *Ergolis merione* for instance rests all day in the very middle of the upper surface of the leaf and is quite safe ; it of course never

comes down to the soil, pupating on the leaf. This does not apply to caterpillars feeding on low plants that a Mynah, for instance, can get at, and for all caterpillars that pupate in the soil, as the Sphingids, there is that risky period when they must descend and seek a place to burrow into the soil. Most do so at night, but many probably perish and in a big caterpillar attack, it is very striking to see the birds collect to feed when the caterpillars descend to pupate; we use this in fighting caterpillar attacks by cutting bands of the crop across which the caterpillars can pass only on the soil where the birds can get them, and from the rapidity with which birds come it is evident they watch insects pretty closely. The reason so many Noctuid larvæ hide during the day is probably simply to escape the birds, and if one watches caterpillars, one can get a picture of the ceaseless watch kept by the birds and the ceaseless attempts of the caterpillars to evade them. Apart from direct observation one can infer it by the devices so common among caterpillars to escape the observation of, not parasites, but birds. This is a subject that could be discussed in very great detail, but would be out of place here.

In estimating the actual food of birds, one must remember that caterpillars are soft, are very often squashed or torn by the bird in or before the process of eating and are not easy to recognise at all. Our knowledge of Indian caterpillars is not detailed; we have had to collect and compare caterpillars of many kinds in India to be able to recognise even our pests from the caterpillar stage alone and as a rule when a bird has taken caterpillars one cannot identify them; we have to rely more upon observation than upon detailed stomach records. I attribute to birds a very great rôle in checking caterpillars alone, and I believe that the reason why a big caterpillar outbreak is seldom followed by another big brood is due to the work of birds in catching the pupating larvæ as much as to the action of parasites. If this is true, then the direct action of birds in preserving crops is immensely important, but it is a matter difficult of direct proof and must depend upon one's personal estimate of the influence of birds.

The flies (Diptera) are of less importance directly and do not figure much in stomach records except with such birds as swallows, swifts, wagtails, fly-catchers and bee-eaters. Probably Dragon-flies feed immensely on small flies, but among birds only the swallows and their allies probably exert much influence on the numbers of flies. With the Plant Bugs (*Hemiptera Heteroptera*) we have a group of minor importance, and in which the acrid scent is probably a protection, though some birds eat them. The Painted Bug (*Bagrada picta*) is, for instance, taken very little despite its abundance; our worst bug-pest, the Rice Bug, is not recorded at all, though very common; the Red Cotton Bug (*Dysdercus cingulatus*) is taken by four birds only, though at times immensely abundant, and though inodorous. We may draw attention to the fact that the beneficial predaceous bugs (*Amyoteinæ, Reduviidæ*, etc.), do not seem to be eaten by birds.

In the Homopterous bugs, birds do little to check their increase even with such abundant forms as *Pyrilla aberrans:* this may be due to the difficulty of actually getting them off the leaves of the cane plant. Aphids are eaten by some birds which seem to be specially adapted to feeding on small plants and eating them, but it is doubtful how far they help to check them. Scale insects are little recorded, except the Giant Mealy Bug (*Monophlebus*), but probably they are fed on to some extent.

In this summary we have tried to picture generally the influence and value of birds, but this is difficult to present vividly to any but persons to whom the names of the insects really represent definite injurious insects, which cause large losses to agriculture. The impression one gains by reading the detailed records and by correlating it with one's knowledge of the insects is of a ceaseless war waged by birds, not as a war but as the daily search for food, on edible insects which are mainly those destructive ones which have a compensating very high ratio of increase and which are ceaselessly breeding and increasing against the ravages caused in their numbers by their enemies; one can picture the caterpillars living under constant menace (not known to them) of discovery by birds; they are

not exempt even in their pupal condition in the soil, the Hoopoe especially probably getting many in this way; even as moths they are attacked, though in this stage their protective attitudes and colouration protects them to some extent. So too for almost every class of destructive insect: grasshoppers are extensively eaten and have little protection, except when on swaying plants which afford little foothold to birds; even the larger locusts are attacked; termites are enormously eaten in the stage in which they are capable of forming new nests. Beetles are extensively eaten and so are, to a less extent, the bugs. On the other hand there is little destruction of predaceous insects which are beneficial to agriculture; the enormous host of parasitic Ichneumons and Tachinid flies are not eaten, Mantids, predaceous bugs, the predaceous Asilids are practically untouched; the insects feeding on Aphides, the Ladybird beetles and Chrysopids are untouched; the digger wasps and true wasps which constantly check insects are not fed on; and there is scarcely a beneficial insect which is checked to any extent by birds. To anyone who has studied the influence of these beneficial insects, this immunity they have is an enormous factor in preserving the balance of life and in maintaining that equable balance of life which never lets one species become destructively abundant but preserves an equality of all; and that is, to man, the really important thing. It is difficult to overestimate the value of birds as a class and their special function seems to be, not so much the keeping down of individual destructive species (which is done by the special parasites each destructive insect has), as the cutting off of the crest of the wave of increase, the checking of those insects which by favour of climatic or other influences elude their checks and become abundant.

It is unfortunately not so clear how to encourage birds to increase; clearly, to increase the numbers of insect-feeding ones one must also increase the food and the most we can do is to see that they are not checked and that in every locality there are as many birds as the insect supply will feed, *i.e.*, these birds require only protection. In the case of the King-Crow especially, I would extend the practice

of perches in paddy fields and similar low crops by putting in upright sticks and branches, as is done in some places, simply in order to concentrate these birds where we most want them, in the paddy fields. For our most important bird, the Mynah, I would advocate the extensive planting of fig trees such as the pipal, banyan, gular, etc., as providing it with shelter and with food so as to keep its numbers up to the maximum: this can be done only by roadside tree-planting and in the selection of trees for this purpose I would put greater value on these trees than on others. The destruction of the Rufous Short-toed Lark or Ortolan should be totally prohibited and this bird should be recognised as one deserving of protection. So also the Indian Roller or Blue Jay deserves protection. The Spotted Owlet and Kites one cannot probably help as they are not killed, but the Black Partridge deserves protection.

A great deal is written about the destruction of birds for plumage by two classes of people, those who want to protect them, and who say they are shot or killed extensively and are smuggled out of India in spite of the prohibition of the export of the Plumage of Wild Birds in India, and those who want to let this export go on openly, as legitimate trade. Of the birds known to be exported, the Cattle Egret and the Jay are the only ones we can definitely say are beneficial in any way. Their destruction and exportation should be prohibited. On the other hand, the Rose-Ringed Parroquet and all Parroquets deserve to be exterminated, and if exportation of plumage will encourage this it is a mistake to prohibit this exportation. So for the Ibises, Storks, and Herons; there is no evidence that they do anything but harm, and no argument for their preservation can be based on their beneficial action. On the other hand it is not possible to say that the birds killed for plumage are in the main destructive, or in any way affect the ryot. The Parroquets do, as we have said, and they should be destroyed and the export of their plumage made legal. The Egrets in general, the Peacocks, the Jungle Cocks, the King-Fishers, the Pheasants do not affect the ryot. Their destruction for plumage will not in any way benefit nor harm the ryot. The destruction of Cranes, Parroquets and

some Herons will benefit the ryot, while the destruction of the Cattle Egrets and the Jays will do him damage. It is evident that neither the bird protectionists nor the plumage exporters are wholly right, and that it is necessary to distinguish carefully in the case of each bird.

CONCLUSIONS.

(1) In agricultural tracts, the birds play an indispensable part in the protection of crops from insects.

(2) The following have an injurious action:—

Rose-Ringed Parroquet and other Parroquets.
The Cranes.
The Herons.
The House Sparrow.
Common Indian Green Barbet.
The Bee-eaters.

(3) The following deserve protection, being markedly beneficial.

The Indian Roller.
The Ortolan.
Crows (?)
The King-Crow.
Mynahs.
The Hoopoe.
The Spotted Owlet.
Kites.
The Black Partridge.
The Cattle Egret.

(4) Legislation to protect birds or to prohibit export of plumage needs to discriminate between beneficial and other birds.

(5) Tree-planting on roadsides is probably the most important direct way of encouraging beneficial birds, especially if preference is given to wild Fig trees and other trees, affording food and shelter to the birds feeding both on fruits and on insects.

H. MAXWELL-LEFROY.

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